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THE IMPACT OF TECHNOLOGY ON THE FUTURE OF THE U.S. FARM

HEARING
BEFORE THE
SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-NINTH CONGRESS
FIRST SESSION
MARCH 19, 1985
[No. 10]

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**Serving on Committee on the Budget for 99th Congress.

CONTENTS

WITNESSES

March 19, 1985:	Page
Dr. Michael J. Phillips, Project Director, Office of Technology Assessment, accompanied by Dr. B.R. Eddleman, professor, Mississippi State University.....	13
Dr. Charles C. Kidd, dean of the College of Engineering Sciences, Technology and Agriculture, Florida A&M University.....	41
Don Shelton, grain farmer and owner, Shelton Seed, Centralia, MO.....	60
Dr. Orville G. Bentley, Assistant Secretary, Science and Education, Department of Agriculture.....	75

APPENDIX

ADDITIONAL STATEMENT FOR THE RECORD

J. Bruce Bullock, professor and chairman, University of Missouri, Columbia....	107
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THE IMPACT OF TECHNOLOGY ON THE FUTURE OF THE U.S. FARM

TUESDAY, MARCH 19, 1985

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Washington, DC.

The subcommittee met, pursuant to notice, at 8:43 a.m., in room 2318, Rayburn House Office Building, Hon. Harold Volkmer (chairman of the subcommittee) presiding.

Present: Representatives Volkmer, Andrews, Traficant, Packard, Lujan, and Sensenbrenner.

Mr. VOLKMER. Good morning.

The Subcommittee on Investigations and Oversight will come to order.

According to a recent unpublished U.S. Department of Agriculture study, over 13 percent of medium-sized U.S. farms are insolvent or on the brink of going broke. For the near term, prospects for these 93,000 farms look bleak.

In my own district, northeast Missouri, the percentage of family farms facing severe economic problems is even greater. While there may be disagreement about the exact numbers, there is no disputing the fact that many farms will not survive this year. However bleak the short-term prospects are, the long-term outlook is worse.

Today, we will release an Office of Technology Assessment study on the impact of technology on farms. The study concludes that unless many farmers adopt new technologies quickly, then they must find off-farm income or give up farming altogether. And the most vulnerable segment of the farming community, according to the OTA study, is the medium-sized farm, which to me has always been meant as a family farm.

If these are the only options facing many farmers, then the farm crisis has, indeed, become a disaster.

The OTA report does offer a glimmer of hope for some of these farmers, in its suggestion of the potential of new technologies for the farm. But these technologies need to be developed, and ways must be found to make these technologies more available to farmers and to provide training in their use.

Today, we will examine these and other significant conclusions reached in the OTA report. We will also seek answers to questions about the adequacy and focus of agricultural research programs.

Some of these questions are: Do current research programs have a bias toward large farms? Are any technologies being developed

for moderate or medium-size farms? How can the technology needs of moderate and small-sized farms best be met?

We in the Congress must address these problems through policies that benefit the entire farming sector of the United States.

At this time I would like to recognize the gentleman from California, Mr. Packard, for any statement he may wish to make.

Mr. PACKARD. Mr. Chairman, before I make my statement, I would like to ask unanimous consent that the hearing record on the hearing that we are having this morning be kept open for 3 weeks, if possible. There may be witnesses that would like to submit written testimony from the California Farm Bureau and perhaps others. Would that be permissible?

Mr. VOLKMER. I have no objection. Without objection, the record will remain open for 3 weeks.

Mr. PACKARD. Thank you.

[Material to be supplied follows:]

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

OPENING STATEMENT

HON. DON FUQUA, CHAIRMAN
COMMITTEE ON SCIENCE AND TECHNOLOGY

MARCH 19, 1985

THANK YOU MR. CHAIRMAN.

BIOTECHNOLOGY, ADVANCED COMPUTERS AND NEW TECHNOLOGIES CAN
AND WILL DRAMATICALLY CHANGE THE FACE OF THE AMERICAN
AGRICULTURE INDUSTRY. BUT, IT IS CRITICAL THAT WE DEVELOP
POLICIES THAT WILL PERMIT THE BEST UTILIZATION OF THESE
TECHNOLOGIES.

LET ME USE AN EXAMPLE TO ILLUSTRATE THE POINT. FROST AND ICE FORM AROUND THE BACTERIA ON LEAVES AND STEMS OF PLANTS AND THIS IS WHAT CAUSES FROST DAMAGE TO PLANTS. RECENTLY, SCIENTISTS DEVELOPED A TECHNIQUE TO REMOVE THE GENE IN THAT BACTERIA THAT CONTRIBUTES TO ICE FORMATION. THE EFFECT IS TO RAISE THE TEMPERATURE AT WHICH FROST DAMAGES PLANTS. THIS COULD LEAD TO THE PROTECTION OF FRUITS AND VEGETABLES FROM FROST TO TEMPERATURES AS LOW AS 21 DEGREES FAHRENHEIT.

DURING THE LAST TWO YEARS HEAVY FROSTS HAVE CAUSED MILLIONS OF DOLLARS OF DAMAGE TO THE CITRUS CROP IN FLORIDA. IF THIS FROST PREVENTION TECHNOLOGY BECOMES A REALITY IT COULD HAVE A MAJOR IMPACT ON THE INDUSTRY.

BUT FIRST, MANY ISSUES MUST BE RESOLVED, SUCH AS:

- O WILL IT BE AVAILABLE TO EVERY CITRUS FARM IN FLORIDA OR ONLY TO A FEW?
- O WILL USDA BE ABLE TO PROVIDE INFORMATION AND TECHNICAL TRAINING IN BIOTECHNOLOGY FOR THE FARMERS?
- O WILL THIS TECHNOLOGY BE TOO EXPENSIVE FOR USE BY THE SMALLER-SIZED FARMS?

THE TIME TO SEEK ANSWERS TO THESE QUESTIONS IS NOW, BEFORE THE PROBLEMS BECOME TOO DIFFICULT TO RESOLVE. THAT MAKES THIS IMPORTANT HEARING VERY TIMELY, AND I WANT TO COMPLIMENT THE CHAIRMAN FOR HIS FORESIGHT.

I WOULD ALSO LIKE TO TAKE THIS OPPORTUNITY TO WELCOME ONE OF TODAY'S WITNESSES, DR. CHARLES KIDD, DEAN OF THE COLLEGE OF ENGINEERING SCIENCE, TECHNOLOGY, AND AGRICULTURE AT FLORIDA A&M UNIVERSITY. I HAVE KNOWN DR. KIDD FOR SEVERAL YEARS AND AM WELL AWARE OF HIS NATIONWIDE REPUTATION FOR ADVANCING THE CAUSE OF SMALL-SIZED FARMS.

SMALL FARMS ACCOUNT FOR OVER 50 PERCENT OF ALL FARMS IN THE UNITED STATES. THEREFORE, IT IS IMPORTANT FOR THIS COMMITTEE TO HEAR TESTIMONY ABOUT THE TECHNOLOGY NEEDS OF SMALL FARMS.

I DO NOT THINK WE COULD HAVE A BETTER SPOKESMAN THAN DR. KIDD. WE ARE HAPPY TO HAVE HIM WITH US TODAY.

THANK YOU MR. CHAIRMAN.

April 12, 1985

The Honorable Ron Packard
U.S. House of Representatives
316 Cannon Bldg.
Washington, D.C. 20515

Dear Congressman Packard:

California Farm Bureau Federation just received the Office of Technology Assessment report, "A Special Report for the 1985 Farm Bill." We are pleased to comment on the issues raised in the report concerning impacts of current agricultural research on farm size.

The California Farm Bureau Federation (CFBF) shares the concern voiced in this report on the impact of technology on various classes of farm size. We believe that technological progress ought to be scale neutral in the sense that technological developments are available and accessible to all classes of farm size and that all economically viable farms ought to benefit from technology.

Discussion of technology for "small farms" does not address individual needs, efficient uses of resources, nor good planning. Currently, farms are defined as small, moderate, or large based on gross revenue or sales. Yet such delineations are not particularly useful, for within each category they mask a wide range of economic motivation, tax behavior, ownership arrangements, leverage ratios, non-farm assets, and part-time involvement. Farm definitions based on gross sales say nothing about the purpose of the farming operation or the motivation of the farm operator. We feel a hierarchical scheme, in which the various sub-groups can be delineated, may be more useful to identify target audiences for appropriate technologies. (See chart)

Farm Bureau recognizes the contribution that agricultural research and extension have made to the great gains in productivity and efficiency in American agriculture. We also agree with the conclusion of the report that the consumer has benefitted in the form of abundant supplies at prices requiring an average expense of only 16% of disposable income. In addition, agricultural productivity has benefitted the economy at large through income and employment generation, and has made significant contributions to the U.S. trade balance.

The majority of the agricultural research in the U.S. proceeds on a commodity-by-commodity basis. Given this pattern, it is not surprising that certain crops with large economies of scale (e.g., processing tomatoes, wheat, corn) benefit from agricultural research that tends to be skewed towards farms of larger sizes. To expect otherwise would be to deny the principle of comparative advantage and the tremendous importance and multiplier effects of these crops on the economy as a whole.

However, it does not necessarily follow that the majority of research is concentrated on farms greater than \$200,000 of gross sales. On the contrary, one need only look at the many state and federal marketing orders in California to observe that research proceeds on a scale neutral basis, especially in the development of new varieties. For instance, the cling peach and apricot producers work closely with the University of California to develop new and better varieties, which are available, upon registration, to any producer. The research projects are decided upon by grower representatives through grower committees.

We also have in California, a Limited Scale Agriculture program run by the University of California Cooperative Extension that focuses upon the technological, marketing, and production needs of the "limited scale" farmers. The program operates a resource library and works with small-scale Farm Advisors, a program which the Limited Scale Agriculture Center helped to implement. This Limited Scale program evolved out of needs in 1972 to help Chicano farmworkers become actual farmers. Since then, the Center has branched out servicing some five to ten thousand small farmers. The Center has developed programs in alternative agriculture and direct marketing. It works with six bilingual Farm Advisors, and has published more than 50 technical brochures, some general and some commodity specific on minor specialty crops like carob trees and sugar peas.

We also agree with the report's conclusion that technological utilization relative to farm size is a function of research programs, dissemination, and adoption. In terms of access to information, we would have to agree that growers with large scale farms may have an advantage. A number of factors were mentioned in the report to account for this, including the level of the farmer's education and technical expertise. The report noted that greater producing farmers tend to be more knowledgeable and better educated. If this is true, the fact that larger farms tend to take advantage of educational opportunities should not be surprising. If this were not true, there would be cause for serious concern, since the solution to disparities in inquisitiveness as the result of educational differences does not lie in handicapping the access of technology to the better educated. Another factor not mentioned in the report to account for the disproportionate claim on the resources of the Extension Service may be a disproportionately greater number of full-time farmers in the larger farm size categories.

Therein lies the crux of the problem focused on in the report: adoption not only is a function of availability, but also of willingness. We agree that willingness itself is dependent on the factors mentioned (profitability potential, level of capital investment, level of natural resources controlled by farmers, the economic environment, and the technical skills of the farmer.) We would certainly emphasize the latter, and might add one more, i.e., economic motivation. By this we mean whether the farmer is in business to farm or to generate a tax loss, earn a living or just enjoy country living.

We would refer you to our hierarchical diagram for further gradations of economic behavior. If the intent is a tax write-off, it would make little sense concentrating scarce resources in technology with this sub-class; the opportunity costs would be too great. Similarly, if the intent is to pursue a rural lifestyle, regardless of the level of farm resources, farm profitability, or level of active physical participation, it would be inefficient, from a societal point of view, to concentrate resources there. Further research should examine the sub-categories of farmers within the gross income classifications and make research needs assessments based on livelihood, profit, risk, and tax motivations.

We agree with the University of California that research should be dispersed as broadly as possible. Good farmers will seek out and use the latest technology and manage their operations so they can financially survive. Leveraging the debt load is extremely critical, since returns to equity are low. Therefore, operators with limited assets must be careful to seek and adopt technologies not only technically appropriate, but also financially appropriate.

Farm Bureau appreciates the enormity and complexity of OTA's task in analyzing all the information on the dynamic American farm structure, and drawing meaningful, sensible, and consistent conclusions. We applaud OTA's efforts, and encourage OTA's continuing research.

We appreciate the opportunity to comment on this issue, and look forward to further results of your research.

Sincerely,

GREGORY L. GARNILL
Secretary

GLG:REG:dl



California Farm Bureau Federation

1601 Exposition Boulevard • Sacramento, CA 95815 • Telephone (916) 924-4000

April 23, 1985

The Honorable Ron Packard
U.S. House of Representatives
316 Cannon Building
Washington, D.C. 20515

Dear Congressman Packard:

In our letter to you dated April 12, we inadvertently forgot to complete the diagram presented to show a hierarchical ranking of farm classification. Enclosed please find the completed copy.

The diagram is not meant to be comprehensive, but rather to show the variety and complexity of sub-groups included under the generic term "small farm." The diagram, as presented, symmetrically subdivides the groups beginning with the right-most entry. However, the subdivisions could equally apply to any of the groups, e.g., you could have a solely owned tax-loss enterprise with 50% off farm income with substantial non-farm assets where the owner is highly profit-oriented, highly leveraged, high risk taker, and non-organic grower.

We are not saying that only these divisions are valid. We are only saying that all these divisions do exist and are useful for the purposes of policy discussion and formulation in terms of targeting specific audiences and tailoring agricultural research to meet the special needs of those audiences.

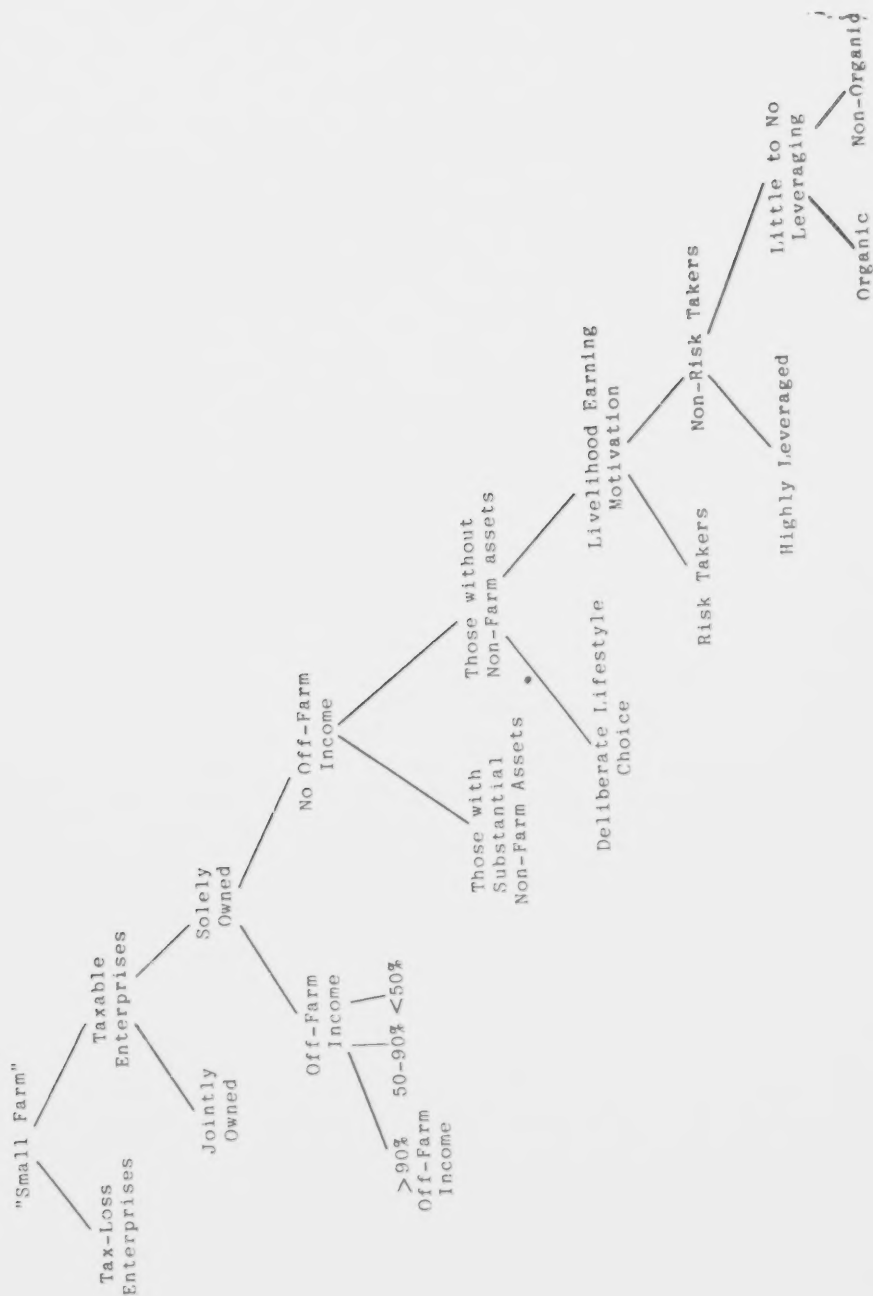
We hope you will find the chart helpful.

Sincerely,



GREGORY L. CARNILL
Secretary

GC:WEG:dh
Enclosure



Mr. PACKARD. Mr. Chairman, we are here today to examine the plight of the small- and moderate-sized farm, family farming operations which have in the past been the backbone of our agricultural economy.

Today, however, these farms are threatened with extinction because of the growth of large, highly technical agribusinesses. These large farming operations thrive in part because they have taken advantage of the many advances in technology available to farmers.

Mr. Chairman, I don't want to see the small- and medium-sized family farms driven out of business because agricultural technology is limited to the large operations. We must make sure that technology is available to all farming operations, large and small.

Government should direct its energies to develop technology which makes agriculture more efficient and productive at all levels. We should also make sure that our educational institutions are bringing the American farmer up to speed with the latest technology.

This, I feel, is a much better use of Government money than the ever-increasing amounts used to try to salvage inefficient farming operations.

In a competitive business environment, we should look at ways to help farmers remain competitive, not only with large agribusiness operations, but also with other agriculture-producing nations in the world.

The answer to the problems facing American agriculture can no longer be found in ever-increasing government subsidies and bailouts. The answer for farms, like any other business, lies in the willingness and ability of the business using technology to become more efficient and productive.

Thank you, Mr. Chairman.

Mr. VOLKMER. Thank you.

Does the gentleman from New Mexico have any statement he wishes to make?

Mr. LUJAN. Thank you, Mr. Chairman.

No, I don't have a prepared statement. I just want to thank you for calling these hearings. I think it is important at this time, when we are having so much difficulty with our farming operations in this country, that such a hearing be held on how technology can help those small-sized farmers. I congratulate you for having this hearing.

Mr. VOLKMER. I thank the gentleman from New Mexico.

Before we begin, I want to first express my gratitude to all the witnesses being here to testify on this very important topic.

I will now call on our first panel, Dr. Michael Phillips, Office of Technology Assessment, and Dr. B.R. Eddleman, Mississippi State University, who assisted in the OTA study.

Your entire statement, Dr. Phillips, will be entered in the record. You may wish to summarize the statement or, if you wish, you may review it in full, however you so desire.

**STATEMENT OF DR. MICHAEL J. PHILLIPS, PROJECT DIRECTOR,
OFFICE OF TECHNOLOGY ASSESSMENT, ACCOMPANIED BY DR.
B.R. EDDLEMAN, PROFESSOR, MISSISSIPPI STATE UNIVERSITY**

Mr. PHILLIPS. Mr. Chairman and members of the committee, we want to thank you for inviting the Office of Technology Assessment to appear before you today to discuss issues in agriculture research and extension policy which affect farm structure.

These issues, as you have already alluded to, are part of a study on technology, public policy, and structural change in U.S. agriculture which the House Science and Technology Committee, among others, has requested from OTA, that will be completed later this year. As you have pointed out, later today we will be releasing an interim report that relates to these issues and the 1985 farm bill.

I am Michael Phillips, project director of this requested study. Accompanying me today is Dr. Eddleman, Mississippi State University, a member of the project team, who will participate in the question-and-answer session following the testimony.

Today we will focus on the committee's interest on the impact of emerging agricultural technologies and their potential use by different sizes of farms.

As you have indicated, my written testimony will be made available for the record, and I will summarize that testimony in my oral comments here.

My testimony will, first of all, briefly describe some of these emerging technologies; second, indicate who gains from technology change; and, third, discuss the effects of agricultural research and extension policy on farm structure.

Technology has made U.S. agriculture one of the most productive in the world. Some of that technology has taken the form of new products: chemicals to control pests, drugs to control disease, or sensors and computers that automatically measure moisture conditions.

Other technology has been embodied in new processes, such as the ability to use computers to make better economic decisions, or to apply the best combination of cultural practices.

Emerging technologies encompass both products and processes and, like their predecessors, promise to reshape the practices of agriculture. Indeed, recent breakthroughs in biotechnology and information technology could revolutionize agricultural production.

For instance, before the turn of the century, cattle ranchers may be able to raise cattle twice their present size with no additional feed. Dairy farmers may be able to control the sex of calves and increase milk production without increasing feed intake.

Major crops may be altered genetically to resist pests and disease, to grow in salty soils and harsh climates, and to provide part of their own fertilizer. And new computers and electronics will be used to increase farm management efficiency.

While it may sound somewhat like science fiction, advances in biotechnology and information technology will make the adoption of these technologies a reality in the very near future.

My written testimony details some of the specific advances in biotechnology and information technology which will make this possible. Suffice it to say that technical advances in mass produc-

tion of microorganisms, of proteinaceous pharmaceuticals, gene and embryo manipulations in animals, microbiocinoculums and genetic modification in plants, and integration of computers and electronics into modern livestock production systems will account for many of these fantastic breakthroughs which will dramatically change the agricultural production.

Agriculture's entrance into the era of biotechnology and information technology raises several questions about the impact of technological advance on the performance of the research and extension system and about how that performance ultimately will affect the structure of agriculture.

One of the important questions to address is, who gains from technology change? Three important conclusions emerge from past studies of technology change in agriculture regarding who benefits and who loses from such technology advances and the implications for structural change in farming. And we believe these conclusions will be applicable for the biotechnology and information technology era.

First, those farmers who are the most aggressive and incur the initial risk in effectively adopting and applying new technologies are the most likely to survive over time. Their size or scale of operation thereby influences the structure of agriculture.

To the extent that research discoveries or extension programs favor farm operations of a certain scale, the structure of the farming industry is affected by research and extension. The significance of technology's role in fostering structural change makes it an important factor to consider when designing research and extension programs.

Second, research and extension are vital to maintaining the competitiveness and the comparative advantage of U.S. agriculture in international trade. Maintaining or increasing the U.S. share in agricultural export markets cannot be maintained without the benefits of continuous development and adoption of cost-reducing technologies.

Third, the ultimate beneficiary of agricultural research and extension is the consumer, both domestic and foreign. Larger supplies, lower food prices, and better quality have almost invariably been the main results of agricultural research.

This does not mean that research operates contrary to the interest of all farmers; rather, research directly benefits the more progressive farmers who are the first to adopt the research results.

The impact of research and extension on farms depends on the types of technology developed and the rates of adoption. Research and extension impacts on the structure of the farming industry can best be understood by considering the separate effects of research, extension, and technology adoption.

First, I will address research. A research program that is structurally neutral would develop technologies that can be used by any size farm. Available evidence indicates that the biological-chemical technologies are more likely to be structurally neutral than is mechanical research.

The biological-chemical technologies over the past 50 years have accounted for nearly a doubling of output in most farm commodities—for example, wheat, corn, rice, and cotton—on all sizes of

farms. However, mechanization and economies of size have accounted for a tenfold to twentyfold increase in output of these commodities, and this has not been structurally neutral.

We find little evidence to indicate that research to develop biotechnologies and information technologies is likely to be biased toward any particular size of farm. Technology dissemination that is structurally neutral can be transferred by researchers and extension staff to all farmers.

Although the extension service disseminates research results through a wide range of publications, public meetings, and result demonstrations, these means are more readily accessed by the more knowledgeable and better educated farmers, who more often than not are the operators of larger, more progressive farms.

To this extent, dissemination of current research results that encompass the topics covered in publications and public meetings tend to be less structurally neutral than the research itself.

Adaption that is structurally neutral involves equal willingness and ability of operators of all farm sizes to adapt to new technology. Even when research and extension activities are structurally neutral, adaption may not be neutral because it is dependent on such factors as the potential profitability of the technology, the capital investment required for adaption, the natural resources controlled by farmers, the economic environment within which farmers operate, and the technical and managerial skills of the farmer.

The structural trend in agriculture today is moving quite clearly toward a bimodal distribution—small and large farms surviving, with moderate farms struggling to exist.

Small farms are surviving because they have off-farm income against which to offset farm losses. Large farms are increasing in number because their operators generally are more efficient and can purchase inputs at lower prices, many times sell their products at higher prices, obtain more farm program benefits, and therefore have higher incomes.

Considering the number and complexity of these factors, it would be difficult to achieve a farm structure that maintains the moderate-sized farm simply by focusing more resources on producing and disseminating technologies specifically oriented toward this farm segment. Instead, research and extension activities would have to be integrated into other targeted policy tools to achieve such structural goals.

Since dissemination and adaption would appear to be more important than research to structural change, the emphasis in a program to achieve greater neutrality would logically fall in highly applied research and extension functions aimed at the competitiveness and the survival of moderate farms.

However, available evidence indicates that the progress of the agricultural research community is more advanced in establishing priorities than that of the extension community. The agricultural research system, which includes the USDA and our land-grant institutions, has adjusted the distribution of its resources in recognition of potential advances evolving from biotechnology and information technology.

Similar progress, however, is not apparent in extension. Federal extension has dramatically deemphasized its direct education role over the past 20 years. Federal extension specialists are viewed today more as program leaders, coordinators, and facilitators rather than as educators engaged in staff training and in conducting educational programs.

This change in the role of Federal extension has adversely affected the overall National Extension Education Program, a program left to itself to cope with a lack of progress in national planning and needs assessment and a deterioration in the quality of educational service to the States.

The biotechnology era presents important challenges to the extension community. With renewed emphasis on basic agricultural research in the land-grant universities, extension could increase its involvement in evaluation of technologies and products flowing from the private sector.

Without such evaluation, individual farmers and ranchers may incur exceedingly high costs in terms of costs of wrong decisions of experimenting to determine which combinations are most profitable to use in production.

Substantial challenge is involved in extension's adjusting to this potentially new role. While in some States technology and extension are already deeply involved in the evaluation of new products, in other States product evaluation has been primarily a function of experiment stations.

In the future, experiment stations will likely be doing less of this work, and extension's responsibilities will correspondingly increase. Meeting this increased responsibility will entail a larger specialist staff having modern scientific training.

Some States may be inclined to forego the responsibility of becoming involved in conflict-oriented product evaluation programs. To the extent that this occurs, the usefulness of extension to the farmer will decline.

Many technologies on the horizon are exceedingly complex and foreign to many extension staff. In the foreseeable future, embryo transplant technology may be as important to the dairy industry as artificial insemination has been over the past three decades.

Growth regulators will increasingly be applied in minute quantities to plants to increase productivity. New strains of genetically engineered plants and animals will be entering commercial production channels.

Extensive staff training and development will be required at both the specialist and county levels for extension to play an effective role in technology transfer during the biotechnology era.

Without such training, extension will play a decreasing role in production agriculture. Technology transfer will occur less efficiently with more structural impacts. Large farms will benefit at the expense of smaller farms.

This concludes my testimony, Mr. Chairman. Dr. Eddleman and I will be glad to try to answer any questions that you and the committee might have.

[The prepared statement of Dr. Phillips follows:]

TESTIMONY OF DR. MICHAEL J. PHILLIPS
PROJECT DIRECTOR, FOOD AND RENEWABLE RESOURCES PROGRAM
OFFICE OF TECHNOLOGY ASSESSMENT, U.S. CONGRESS
BEFORE THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

EFFECT OF AGRICULTURAL RESEARCH AND EXTENSION POLICY ON FARM STRUCTURE

MARCH 19, 1985

Mr. Chairman and Members of the Committee:

Thank you for inviting the Office of Technology Assessment (OTA) to appear before you today to discuss issues in agricultural research and extension policy which effect farm structure - the organization and control of farm resources. These issues are part of a study on technology, public policy, and structural change in U.S. agriculture which the House Science and Technology Committee, among others, has requested from OTA that will be completed late this summer. I am Dr. Michael J. Phillips, Project Director of the requested study. Accompanying me today is Dr. B. R. Eddleman, Mississippi State University, a member of the project team who will participate in the question and answer session following the testimony. Today we will focus on the Committee's interest on the impact of emerging agricultural technologies and their potential use by different sizes of farms. My testimony will 1) briefly describe some of the emerging technologies, 2) indicate who gains from technology change, and 3) discuss the effect of agricultural research and extension policy on farm structure.

The Emerging Agricultural Technologies

Technology has made U.S. agriculture one of the most productive in the world. Some of that technology has taken the form of new products--chemicals to control pests, drugs to control disease, or sensors and computers that automatically measure moisture conditions. Other technology has been embodied

in new processes--such as the ability to use computers to make better economic decisions, or to apply the best combination of cultural practices. Emerging technologies encompass both products and processes and like their predecessors, promise to reshape the practices of agriculture. Indeed, recent breakthroughs in biotechnology and information technology could revolutionize agricultural production.

For instance, before the turn of the century, cattle ranchers may be able to raise cattle twice their present size with no additional feed, and dairy farmers may be able to control the sex of calves and to increase milk production without increasing feed intake. Major crops may be altered genetically to resist pests and disease, to grow in salty soils and harsh climates, and to provide part of their own fertilizer. And new computers and electronics will be used to increase farm management efficiency. While it may sound somewhat like science fiction, advances in biotechnology and information technology will make the adoption of these technologies a reality in the very near future.

Biotechnology

One of the major thrusts of genetic engineering in animals is the mass production in microorganisms of proteinaceous pharmaceuticals, including a number of hormones, enzymes, activating factors, amino acids, and feed supplements. One application of these new pharmaceuticals is in the injection of growth hormones into animals to increase productivity. Several firms are developing genetically engineered bovine growth hormone to stimulate lactation in cows. Trial results show that each cow treated with the hormone increased milk production by at least 12 percent without increasing feed intake.

Commercial introduction of the new hormone now awaits approval by the Food and Drug Administration (FDA).

A new technique arising from the convergence of gene and embryo manipulations promises to permit genes for new traits to be inserted into the reproductive cells of livestock and poultry, opening a new world of improvement in animal health and productivity. Unlike genetically engineered growth hormone, which increases an animal's productivity but does not affect future generations, this technique will allow future animals to be permanently endowed with traits taken from other animals and humans, and probably also of plants.

In 1983, scientists at the University of Pennsylvania and University of Washington successfully inserted a human growth hormone gene, a gene that produces growth hormone in human beings, into the embryo of a mouse to produce a "supermouse" that grew to more than twice the size of a normal mouse. In another experiment, scientists at Ohio University inserted rabbit genes into the embryos of mice. The genetically engineered mice, which were 2.5 times larger than normal, ate as much as normal mice.

Embryo transfer in cows, another technology, involves the artificial insemination of a super-ovulated donor animal. The resulting embryos are removed nonsurgically for implantation in surrogate mothers. Prior to implantation, the embryos can be treated in a number of special ways. They can be sexed, split (generally to make twins), fused with embryos of other animal species (to make chimeric animals or to permit the heterologous species to carry the embryo to term), or frozen in liquid nitrogen. Freezing is of great practical importance because it allows embryos to be stored until the estrus of the intended recipient on the farm is in synchrony with that of the donor. While less than 1 percent of U.S. cattle are involved in embryo

transfers, the obvious benefits will push this percentage upward rapidly, particularly as the costs of the procedure decrease.

The application of biotechnology in plant agriculture could modify crops so that they would make more nutritious protein, resist insects and disease, grow in harsh environments, and provide their own nitrogen fertilizer. While the immediate impacts of biotechnology will be greater for animal agriculture, the long-term impacts are likely to be substantially greater for plant agriculture. I will discuss two potential applications of biotechnology to plant agriculture --microbial inoculums and genetic modification.

Rhizobium seed inoculums are widely used to improve nitrogen fixation by certain legumes. Extensive study of the structure and regulation of the genes involved in bacterial nitrogen fixation will likely lead to the development of more efficient inoculums. Research on other plant colonizing microbes has led to a clearer understanding of their role in plant nutrition, growth stimulation, and disease prevention, and the possibility exists for their modification and use as seed inoculums.

Presently, field tests are being conducted of genetically engineered soil bacteria that produce natural insecticides capable of protecting plant roots against soil-dwelling insects. A genetic engineering technique has been developed that inserts into soil bacteria a gene from a microorganism known as Bacillus thuringiensis, which has been registered as an insecticide for at least two decades. Plant seeds can be coated with these bacteria before planting. As the plants grow from these buds, the bacteria remain in the soil near the plant roots, generating an insecticide that protects the plants.

The targets of crop improvement via genetic modification are essentially the same as those of traditional breeding approaches: increased yield, improved qualitative traits, and reduced labor and production costs. However,

the newer technology offers the potential to accelerate the rate and type of improvements beyond that possible by traditional breeding.

Of the various biotechnological methods that are being used in crop improvement, plant genetic engineering is the least established but the most likely to have a major impact. Using gene transfer techniques, it is possible to introduce deoxyribonucleic acid (DNA) from one plant into another plant, regardless of normal species and sexual barriers. For example, it is possible to introduce storage protein genes from French bean plants into tobacco plants and to introduce genes encoding photosynthetic proteins from pea plants into petunia plants.

Transformation technology also allows introduction of DNA coding sequences from virtually any source into plants, providing they are engineered with the appropriate plant-gene regulatory signals. Several bacterial genes have now been modified and shown to function in plants. By eliminating sexual barriers to gene transfer, genetic engineering will greatly increase the genetic diversity of plants.

Information Technology

One of the most significant changes in future livestock production will come from the integration of computers and electronics into a modern livestock production system, technology that will help the farmer improve management.

Computers and electronic devices can be used efficiently in animal feeding, reproduction, disease control, and environmental control. The first step toward efficient management will be with electronic animal identification. Positive identification of animals is necessary in all facets of management, including recordkeeping, individualized feed control, genetic improvement, and disease control. Animals will be identified soon after birth

with a device that will last the life of the animal. The device will be readable with accuracy and speed from 5-10 feet for animals in confinement and at much greater distances for animals in feedlots or on pasture. Research on identification systems for animals has been in progress for some years, especially for dairy cows. For example, an electronic device now used on dairy cows is a transponder that is worn in the ear or on a neck chain. A feed-dispensing device identifies the animal by its transponder and feeds the animal for maximum efficiency, according to stage of production. It also permits animals in different stages of production to be penned together yet still be maintained on its own special diet.

The largest potential use of electronic devices in livestock production will be in the area of reproduction and genetic improvement. An inexpensive estrus detection device, for example, would prove profitable in several ways:

- Animals could be rebred faster after weaning and increase the number of litters per year.
- Animals that did not breed could be culled from the herd, saving on feeding and breeding space.
- Time would be saved because breeding would be done faster.
- Embryo transplants would be easier because of better estrus detection.

Who Gains from the Technology Change

Agriculture's entrance into the era of biotechnology and information technology raises several questions about the impact of technological advance on the performance of the research and extension system and about how that performance ultimately will affect the structure of agriculture. One of the important questions to address is, who gains from technology change?

Three important conclusions emerge from past studies of technology change in agriculture regarding who benefits and who loses from such technology advance and the implications for structural change in farming. And we believe these conclusions will be applicable for the biotechnology and information technology era.

- Those farmers who are most aggressive and incur the initial risk in effectively adopting and applying new technologies are the most likely to survive over time. Their size or scale of operation thereby influences the structure of agriculture. To the extent that research discoveries or extension programs favor farm operations of a certain scale, the structure of the farming industry is affected by research and extension. The significance of technology's role in fostering structural change makes it an important factor to consider when designing research and extension programs.
- Research and extension are vital to maintaining the competitiveness and comparative advantage of U.S. agriculture in international trade. Competition in export markets is becoming increasingly keen as countries strive to expand agricultural output and export to earn foreign exchange. Maintaining and/or increasing the U.S. share in agricultural export markets cannot be maintained without the benefits of continuous development and adoption of cost-reducing technologies.

- The ultimate beneficiary of agricultural research and extension is the consumer--domestic and foreign. Larger supplies, lower food prices, and better quality have almost invariably been the main results of the agricultural research. This does not mean that research operates contrary to the interest of all farmers; rather, research directly benefits the more progressive farmers who are the first to adopt the research results. Research is also critical for expanding markets for farm products and for overcoming the constant threat of disease and other vagaries of nature.

The Effect of Agricultural Research and Extension on Farm Structure

The impacts of research and extension on farms, farm workers, agribusinesses and rural communities depend on the types of technology developed and the rates of adoption. Research and extension impacts on the structure of the farming industry can best be understood by considering the separate effects of research, extension, and technology adoption.

A research program that is structurally neutral would develop technologies that can be used by any size farm. Available evidence indicates that the biological-chemical technologies are more likely to be structurally neutral than is mechanical research. The biological-chemical technologies over the past 50 years have accounted for nearly a doubling of output in most farm commodities--e.g., wheat, corn, rice, and cotton--on all sizes of farms. However, mechanization and economies of size have accounted for a tenfold to twentyfold increase in output of these commodities, and this has not been structurally neutral. We find little evidence to indicate that

research to develop biotechnologies and information technologies are likely to be biased toward any particular size of farm.

Technology dissemination that is structurally neutral can be transferred by researchers and extension staff to all farmers. Although the extension service disseminates research results through a wide range of publications, public meetings, and result demonstrations, these means are more readily accessed by the more knowledgeable and better educated farmers, who more often are the operators of larger, more progressive farms. To this extent dissemination of current research results that encompass the topics covered in publications and public meetings, tends to be less structurally neutral than the research itself. A common counter argument is that the operators of the larger, more progressive farms are more knowledgeable about state of the art technologies than are extension staff.

Adoption that is structurally neutral involves equal willingness and ability of operators of all farm sizes to adopt new technology. Even when research and extension activities are structurally neutral, adoption may not be neutral because it is dependent on such factors as the potential profitability of the technology, the capital investment required for adoption, the natural resources controlled by farmers, the economic environment within which farmers operate, and the technical and managerial skills of the farmer.

The structural trend in agriculture today is moving quite clearly toward a bimodal distribution--small and large farms surviving, with moderate farms struggling to exist. Small farms are surviving because they have off-farm income against which to off-set farm losses. Large farms are increasing in number because their operators generally are more efficient and can purchase inputs at lower prices, sell their products at higher prices, obtain more farm program benefits, and therefore have higher incomes.

Considering the number and complexity of these factors, it would be difficult to achieve a farm structure that maintains the moderate-size farm simply by focusing more resources on producing and disseminating technologies specifically oriented toward this farm segment. Instead, research and extension activities would have to be integrated into other targeted policy tools to achieve such structural goals.

Since dissemination and adoption would appear to be more important than research to structural change, the emphasis in a program to achieve greater neutrality would logically fall in highly applied research and extension functions aimed at the competitiveness and survival of moderate farms. However, available evidence indicates that the progress of the agricultural research community is more advanced in establishing priorities than that of the extension community. The agricultural research system has adjusted the distribution of its resources in recognition of potential advances evolving from biotechnology and information technology. Similar progress is not apparent in extension.

Federal extension has dramatically de-emphasized its direct education role over the past 20 years. Federal extension specialists are viewed today more as program leaders, coordinators, and facilitators rather than as educators engaged in staff training and in conducting educational programs. This change in the role of Federal extension has adversely affected the overall national extension education program, a program left to itself to cope with a lack of progress in national planning - and needs - assessment and a deterioration in the quality of educational service to the States.

The biotechnology era presents important challenges to the extension community. With renewed emphasis on basic agricultural research in the land grant universities, extension could increase its involvement in evaluation

of technologies and products flowing from the private sector. Without such evaluation, individual farmers and ranchers may incur exceedingly high costs (in terms of the costs of wrong decisions) of experimenting to determine which combinations are most profitable to use in production.

Substantial challenge is involved in extension's adjusting to this potentially new role. While in some States technology and extension is already deeply involved in the evaluation of new products, in other States product evaluation has been primarily a function of experiment stations. In the future, experiment stations will likely be doing less of this work, and extension's responsibilities will correspondingly increase. Meeting this increased responsibility will entail a larger specialist staff having modern scientific training. Some States may be inclined to forego the responsibility of becoming involved in conflict-oriented product evaluation programs. To the extent that this occurs, the usefulness of extension to the farmer will decline.

Many technologies on the horizon are exceedingly complex and foreign to many extension staff. In the foreseeable future, embryo transplant technology may be as important to the dairy industry as artificial insemination has been over the past three decades. Growth regulators will increasingly be applied in minute quantities to plants to increase productivity. New strains of genetically engineered plants and animals will be entering commercial production channels. Extensive staff training and development will be required at both the specialist and county levels for extension to play an effective role in technology transfer during the biotechnology era. Without such training, extension will play a decreasing role in production agriculture. Technology transfer will occur less efficiently with more structural impacts--large farms will benefit at the expense of smaller farms.

Mr. VOLKMER. Thank you very much, Dr. Phillips.

I will start out with a couple of questions, and we will proceed under the 5-minute rule and hope we can stay with that pretty closely. If we have to come back and make a second round, we will do a second or third round if necessary for all the members.

I think one of the primary points that concerns me, being from the Midwest and seeing what is going on, and being from an area that has been hard hit by weather conditions and poor prices the last 4 out of 5 years, part of the OTA's conclusion is, farmers that lack the capital and expertise to adopt new technology early enough to maintain a competitive edge must seek supplementary off-farm income, find some special niche for their products, or give up farming altogether.

Now, what data was the give up farming altogether conclusion based on? I would like to know what are the strengths and weaknesses of this data base.

Mr. PHILLIPS. Well, essentially, the data base that was used for that was to be looking at trends, at what has taken place in the agricultural sector over the past 20 years, and using, particularly, the 1892 agricultural census.

You will see in another chapter of this report that we did not allude to in the testimony here that there is a very, I think, graphic table—it is table 3-2—that lays out by size of farm the percent of net income, the percent of sales, and the number of farms in each of these categories from small all the way to very large.

Essentially, the upshot of that table is that the moderate-sized farm, of all those farms, is in the worst financial situation of all farms because they have to be able to bring in almost as much off the farm as they make on the farm to eke out an existence.

Mr. VOLKMER. But they don't have time to do it, most of them.

Mr. PHILLIPS. Well, many of them do not. It essentially means that the wife may be taking a job. There is a second job somewhere. And if they were just to rely on their farm income, they would not be able to economically exist as a farming entity.

Mr. VOLKMER. Now, when we are talking about the moderate size, we are talking about a farm not by acreage or number of livestock but based on annual sales of \$100,000 to \$199,000. Is that correct?

Mr. PHILLIPS. Yes. That is our definition.

Mr. VOLKMER. That is what I basically have seen going on right now, that the family has to work almost full time to operate that farm. They don't have much time to have off-farm income, and yet there is not sufficient net income from that farm today to provide for a family.

Mr. PHILLIPS. That is correct.

Mr. VOLKMER. And you see that trend continuing?

Mr. PHILLIPS. At this point in time, we do, unless there is—assuming the policies that we have today and the economic environment which we are in today—if things do not change, we see the moderate-sized farm having a very, very difficult time existing out to the end of the century.

Mr. VOLKMER. Now, also, that would apply basically to the part-time farm of \$40,000 to \$99,000. Would their off-farm income be sufficient?

Mr. PHILLIPS. Well, the figures, the best that we have them to analyze so far, indicate that their primary source of income is off-farm. They average about \$3,000 onfarm, somewhere around \$15,000 to \$17,000 off-farm.

Now, some may argue that is still not a very sufficient income for a family to exist on, but what we are focusing on in terms of our study—and particularly this interim report that we are releasing later today—is those farms that are trying to exist on basically their farm income, that that is the major source of income coming in, and they are trying to exist as a farm based on that income.

Mr. VOLKMER. Now, as I reviewed the study and in listening to your testimony, it does appear that as new technologies are developed other than machinery and that type of thing, mechanization, but I am talking about the biochemical type and that, they are neutral in bias as far as their development, but as far as their adaption, there is more difficulty for that medium-sized or small-sized farm to be able to adapt to those technologies. Is that correct?

Mr. PHILLIPS. Yes.

Mr. VOLKMER. So what you end up with is, even though the research and development of those things may be neutral, and the adaption is actually neutral as far as any policies are concerned, the practical application is that the adaptations trend toward the larger farms.

Mr. PHILLIPS. Yes.

Mr. VOLKMER. Are there any specific technologies that you know of through this study that you have found that would be beneficial, say, only to the moderate- or part-time farm?

Mr. PHILLIPS. We have not at this point singled out any specific technology that says that that is more applicable to the very small farm than to a large farm. Our basic tenet is that these technologies are applicable to all size farms.

Mr. VOLKMER. All across the board?

Mr. PHILLIPS. All across the board.

Mr. VOLKMER. Do you have any comments you wish to make, Dr. Eddleman?

Mr. EDDLEMAN. No; I do not know of any technology that is specific to a moderate- or small-sized farm that cannot be also adapted to by a large farm. It is really the differential rate of adaption that is the key factor here. And the larger, more progressive farmers that are better educated, that are more on the frontiers of knowledge, that know what is going on, tend to jump in there and adapt to those technologies.

One of our comments is that we think there needs to be some structuring of activities so that they assist these moderate-sized farmers in their adaption processes. The best example I can give you is that many of our biotechnologies require very stringent management practices.

In our region, we have the variety, Lemont rice, which is a new variety. If we had enough seed this year, I think all of the Delta would be in Lemont, but we don't have enough seed this year, so probably 20 percent will be.

Lemont has potentials of increasing yields by 40 percent, and we have actually observed on farms increased yields of 40 percent be-

cause of lack of lodging from this short-statured, short-strawed variety.

But it has three requirements. One is a very, very exact seed placement and seeding rate, which is about $\frac{1}{2}$ inch deep; higher fertilizer requirements; and higher water requirements and timeliness of those water requirements. If you make mistakes, you can lose 40 percent. In other words, your yields can be 75 bushels an acre instead of 130 and 140 bushels an acre, where we are averaging 105.

That is the key factor in terms of education and working with farmers in understanding what these management practices are so that we reduce these costs of wrong decisions.

Mr. VOLKMER. Dr. Eddleman, you mentioned something there—and I am going to go to another member in a minute—but on this new variety of rice, two things: One, the seed is not available for everybody. Is that because of the newness of it, and therefore the seed amount has not been developed?

Mr. EDDLEMAN. Yes, sir, that is correct. It is simply that the seed companies do not have the physical supply.

Mr. VOLKMER. But next year they may, or the following year?

Mr. EDDLEMAN. I think so, that is right.

Mr. VOLKMER. The second thing: In the management problem, what you are telling me is that, in other words, you are going to have to have additional fertilizer, and that is an additional cost to the farmer.

Mr. EDDLEMAN. That is correct.

Mr. VOLKMER. That means that if you are a marginal farmer, you may not be able to use that variety.

Mr. EDDLEMAN. That is correct. And additional water, which is an additional cost, too.

Mr. VOLKMER. Right. So you are going to be left further behind by those who are able to use it. The price that they get for their rice is going to be a lot different from what you get for yours, right? Per bushel, I mean cost per acre.

Mr. EDDLEMAN. Their cost per bushel will go down. It really points to one of those limiting factors in adaption of technology, and that is adequate venture capital; that is, reasonably cost capital—I don't want to say low cost—but reasonably cost capital available in sufficient supply that farmers can do this. The marginal farmer does have some difficulties in that respect.

Mr. VOLKMER. And the other point that I think I would like to make in regard to this is, you mentioned the progressive farmer, the farmer who will get out and go and get ahead.

Now, in my area, we have lost some of those farmers in the last year because they got progressive in the late 1970's, and they over-extended themselves as far as credit was concerned. They increased their land; they increased their mechanization and everything else, and then they couldn't service that debt come the 1980's. What is your answer to that?

Mr. EDDLEMAN. Well, I think this is quite a factor*of just risk taking, and those farmers took risks. Maybe at that time they did not understand, and we did not know precisely, what the nature of those risks was. But it was a result of taking risks. And as a result, they entered into some economic conditions in that they did over-

expand and they did run into some serious cash-flow problems, and some of them are disappearing.

We find in our part of the region, Mr. Volkmer, that not too many of our very large farms are disappearing. It is not farms that are in the neighborhood of, say, \$300,000 or \$400,000 or more worth of sales. The very, very large farms are not disappearing because they grew largely by cash renting, not by buying land.

Mr. VOLKMER. The last question, if you know, for the record, just out of my curiosity, you mentioned the rice.

Approximately what would it cost per acre to put in that variety of rice?

Mr. EDDLEMAN. Our estimates for 1985, which we have completed—each year we put out budgets for the farmers to use for the next planting season—is about \$405 an acre for the total cost—that is, cash cost plus machinery cost and land rent but no general farm overhead costs. It will take about another \$25 an acre, which would make it about \$430 or \$435 an acre, to produce Lemont over the standard tall variety of rice. Rice is a very expensive, high capital cost commodity to produce, as you well know.

Mr. VOLKMER. So if you are going to have 500 acres of that rice, you are going to have better than a \$200,000 investment just getting it in?

Mr. EDDLEMAN. That is correct. In our region—and I think, perhaps, in your part of the State—the typical size parcel is somewhere between 300 and 500 acres, which needs about two wells. There are about 160 to 180 acres per well. You would very easily have a cost of \$200,000 or more of just cash flow required for the production season coming up to produce that amount of rice.

Mr. VOLKMER. I now yield to the gentleman from California.

Mr. PACKARD. Thank you, Mr. Chairman.

Dr. Eddleman, you mentioned that more progressiveness and higher educational skills in part have led to big agricultural businesses at perhaps the expense of the small and midsize farmers. Are you implying that the educational levels of large farmers in the technological areas of farming have exceeded those of the small and midsize farmers?

Mr. EDDLEMAN. That seems to be the truth, sir.

Mr. PACKARD. Let me ask the question, where do you believe that the average farmers, particularly the midsize and small farmers, have come from, out of society, in our past history of this country?

Mr. EDDLEMAN. Well, I think most of them that have grown to that family-size unit are ones who, over the period post-World War II, the 1940's and the 1950's, moved from tenant relationships to part ownership in a farm and eventually moved to full ownership in those farms. They provided for a family income level that was able to support a family, raise a family, and give a reasonable return to that family as an income to their family-owned resources.

I think, in more recent times, it has been much more difficult to go that route.

Mr. PACKARD. I think you have hit upon what I see as one of the major problems, and that is that in the past, most of our small and midsize farmers have come out of family farms. It has been the tradition of the family and of the valley or the area in which they

were raised, myself being included. I was born and raised on a farm but didn't go back to farming.

Do you believe that, in the future, the technology being more and more a significant factor in success in agriculture—and I believe that you are right in those assumptions—that it is going to require more educational background for the successful farmers?

Mr. EDDLEMAN. Without a doubt, I think that is correct.

Mr. PACKARD. Without a doubt, which means that the tradition, as you have already expressed, of coming out of the family farm is going to perhaps shift more to a college background for successful farmers?

Mr. EDDLEMAN. We have already observed this, Mr. Packard.

Mr. PACKARD. If a young man going to college chooses or has to choose, with a 4-year college education, between business, engineering, accounting, or farming, will most of them or many of them choose to go into farming, requiring the same amount of educational skills? Dr. Phillips?

Mr. PHILLIPS. Well, to some extent, if you are assuming that they have come from a farm and have a farm to go back to—in other words, have some economic assistance to get into farming—it may still be a viable alternative.

However, if your example is one in which this student has no farm to go back to, and he wants to go out and start from scratch, that is literally just about going to be impossible for him to even break into farming. It has been tough in the last 10 to 15 years to do that, and we see the barriers to entry just becoming exceedingly high as we progress on through the rest of this century.

Mr. PACKARD. Again, I refer to my own background. When I went to college, I found that farming became less and less attractive to me in comparison to other fields simply because the risks and the levels of potential revenue or income just weren't competitive with other fields.

So, with the same amount of college background, I would assume that it would be more difficult for farming to compete for that student to remain in farming.

My time is nearly gone. Let me ask one more question. What effects, Dr. Phillips, do you think that Government controls, Government price fixing and subsidies and so forth in the farming industry, have had on the small and midsize farmer?

Mr. PHILLIPS. Well, the small and midsize farms have definitely benefited from those programs.

Mr. PACKARD. In what way?

Mr. PHILLIPS. In a way in which they have helped reduce some of the risks. But, at the same time, these programs are available also to the very large farms, and in the grand scheme of things, the very large farms have walked away with the majority of the benefits from these programs.

But it is a mistake to think that small and midsize farms have not benefited. In fact, our analysis shows that if it were not for those programs, these farms would have been gone a long time ago.

Mr. PACKARD. And then, with that statement, are you implying that one of the solutions that might help the midsize farmer survive would be to increase Government assistance and controls?

Mr. PHILLIPS. In terms of some type of income support programs, our analysis shows that it would benefit the moderate-sized operations, and if you targeted those benefits to those sizes of operations and cut off some of the other benefits to the large and very large farms, it will prolong the survival of moderate-sized operations.

Mr. PACKARD. And if that were to become the policy, then do you think that it would become incumbent upon Government to—I will use the word “bail out”—to bail out midsized businesses in America and small businesses that might be struggling on an equal basis, considering farming as a business?

Mr. PHILLIPS. Well, I don't know if we exactly want to use the word “bail out.” I mean, we have had these programs for years. There is a very logical base for these programs in agriculture, because agriculture is a different industry than manufacturing, than other types of examples you might want to point to.

We are essentially saying that some possible restructuring of these programs—if, indeed, Congress policymakers wish to prolong the survival of moderate-size farms, if that is a conscious decision, then our analysis indicates that the targeting of some of these programs in terms of Government programs that you have mentioned, as well as some redirection of, particularly, the technology transfer process, to those sizes of operations, a package of policies in that direction, will indeed help prolong their survival.

Mr. PACKARD. Mr. Chairman, I don't wish to assume more time. I will come back if necessary.

Mr. VOLKMER. I recognize the gentleman from New Mexico.

Mr. LUJAN. Thank you, Mr. Chairman.

Looking at all this technology that we can use, I cannot help but be reminded, when we were growing up, we had a farm that is probably described in the medium sized that you are talking about—it was 300 acres—and we would grow both beans and alfalfa. Maybe some of this technology would cure our problem. It seems like we used to raise alfalfa when beans were high, and we would raise beans when alfalfa was high. [Laughter.]

So maybe some technology might be developed to tell us which one would be the best one to plant.

But expanding further on that and this question of outside income, even at that time, and that was when I was growing up—it was in the 1940's—we could not have made a living on that farm if it were not for outside income.

Let me ask you a couple of specific questions, however. Do we have any less difficulty in getting FDA approval for products used on animals than we do in the case of humans? Is it a little easier to get it through FDA or is it just as difficult?

Mr. PHILLIPS. I am afraid I haven't really thought about that question. We have, for example, this bovine growth hormone, and that may be one you are referring to.

Mr. LUJAN. Yes; that is what I was referring to.

Mr. PHILLIPS. I don't really know how to answer your question in terms of a comparison between humans and animals. In the one particular case we know of with the bovine growth hormone, at this point in time, there does not seem to be any problem with that

being approved. It is just a matter of the time it is going to take to get through the clearance process.

Mr. LUJAN. Do you have to go through the same process for animal products as you do for human products?

Mr. PHILLIPS. Yes; particularly when it is animal products that are going to be consumed by humans. The process is very similar.

Mr. LUJAN. It seems to me at least, or the conclusion I have drawn is that there are a lot of advancements out there but that the staffing of extension programs is not sufficient to meet the need. Do you think that is the greatest need, more than experimentation and seeing what kinds of new products we come out with, that beefing up the extension program is the greatest need, rather than the continued research? Did I gather that correctly?

Mr. PHILLIPS. You are talking just about research and extension, if I understand your question.

Mr. LUJAN. Research and dissemination of that information, yes.

Mr. PHILLIPS. Yes; and if your concern is about prolonging the survival of moderate-sized farms, then yes, we see the need to be that of getting the technology transferred out and the educational process taking place so that farmers can benefit from it.

As Dr. Eddleman was saying with his example, these technologies of the future are going to be very complex, and if you don't apply these technologies properly, it can be devastating to the survival of a farm. So education is going to be key to farmers.

In terms of extension service, we have focused here basically on the public sector, but I might want to also say that there is a role here for the private sector. Take, for example, cooperatives, whose basic membership is moderate-sized farms. There is a great deal that cooperatives can do to also make the acquisition of these technologies and to pass them on to their membership and train them in the use.

We are not saying, and I do not want to imply here in our testimony, that all the burden here is on the public sector. There is a role here for the private sector, also, and some point development of some of these programs would be very beneficial.

Mr. LUJAN. Yes; that is true. We tend to think, well, you know, Ortho is going to do the dissemination of information because they will make more money, the more people know about it. But that is not necessarily so.

Is that a general statement on your part? It seems to me as if there is something that we can do there to direct the Department of Agriculture, for example, in the extension program at State universities. Is that a general statement, or did you take a look at the extension program and find those deficiencies?

Mr. PHILLIPS. Well, yes, we did take a look. We have had an entire work group working over the past year-and-a-half that has spent their time delving into these issues of which we have given you sort of our overall findings in this area, and it is clearly one in which we find that the research community, over the last 4 to 5 years, in particular, has really pulled itself together and is ready to enter this new era.

What we see now is that the same process that the research community went through 4 to 5 years ago, we see the same kind of need taking place now for extension. Extension needs to really

decide what its mission is going to be, and particularly as it relates to what we call here commercial agriculture.

As you know, extension has had other responsibilities put on its platter that don't exactly relate to commercial agriculture. They are no different from any other entity. There are limitations to your resources. I think some really hard decisions are going to have to be made in extension as to what is the specific mission going to be; what are our needs going to be; and how are we going to carry it out.

Mr. LUJAN. I asked that question simply because that is something that we can do something about as Members of Congress. There is very little we can with what kinds of hormones are developed, what kinds of new products come along to make them grow or give more milk or birth more often; but we can on the dissemination of information, and I am glad for that information.

Dr. Eddleman.

Mr. EDDLEMAN. Just a point of clarification that I would like to make. There will be a whole spectrum of complexities from one biotechnology to another. Some of these will be rather simple: Just give an injection. That doesn't really require a high skill level or high management. But, on the other end of that spectrum, if you are talking about embryo transplants within a dairy herd, that can require very, very high skills.

So I don't want to give the impression that all of these biotechnologies require such high levels of education and high levels of skill that they are ruled out without a lot of direct education efforts. Some of them will; some will not. Some will be rather simple.

Mr. LUJAN. Thank you very much.

Mr. VOLKMER. Thank you.

I now recognize the gentleman from Ohio, Mr. Traficant.

Mr. TRAFICANT. Thank you, Mr. Chairman.

I just have a couple of questions. I have been hearing some of the terms thrown around, like the industry, the farm industry, needs venture capital, and the part-time to moderate-sized farms are certainly in danger. We know that.

What program, if any, has either been tried or is on the drawing board or is being considered as a priority that will in some way help to bring a part-time, moderate-sized farmer, who is the foundation of our farming industry, into the main stream and be able to make it? Is there any such thing or animal?

Mr. EDDLEMAN. I can speak to two general types of programs. One has been led by the University of Florida in terms of small farms and moderate-sized farms with multiple cropping in vegetable crops—that is where you can produce two or three crops simultaneously or within a production year—intensive crop production, through the rural development center that exists at the University of Florida.

A second one that I can speak to is that in the economics and farm management areas, there is quite a bit of work that is going on in terms of research and education programs with the use of farm cooperatives.

We feel that one of the reasons that you have a distinction and a differentiation between the large farms and the moderate farms is that those larger farms not only capture significant size economies

just because of their technologies, but they capture significant pecuniary economies because they can buy their inputs much cheaper; and not only that, they can get premiums for their products when they sell them. They have large enough volumes at uniform quality. They can work through contractual arrangements, through options, through futures markets, so that they get a higher price for their commodity.

Quite a bit of work is going on now in terms of increased public research efforts as well as education efforts through extension education in terms of developing management systems that allow some of those economies of size to be captured such as the intensive crop cultivation of the vegetable crops that I talked about.

Second, in terms of research and education with regard to farmers' cooperatives that allow farmers to capture some of the cost economies that are associated with purchasing of inputs.

And, third, in terms of research and the use of modern management tools, including the microcomputer and the software packages, for farmers to understand the marketing—that is, contracting—forward contracting of their crops to lock in and reduce price risk—futures markets and what that means, options, bidding in terms of selling these—in an attempt to help these moderate-sized farmers, through cooperative arrangements and through these marketing arrangements, to capture and achieve some of the things that the larger scale farmers have been able to capture and achieve on their own.

So those are my two examples that I can give you. There is quite a bit of work throughout the Nation on that particular effort.

Mr. TRAFICANT. That is basically the point I would like to make in terms of the farmer of the future. If the small farmers and part-timers are not able to make it, why should a young man, as the gentleman from California discussed, or a family really go into farming? Where is the venture capital going to come from and who is going to be doing the farming, and where will our farmers come from?

As far as the farm bill is concerned, what policy changes or what direction do you see might be included therein that might help this endangered species, if anything?

Mr. PHILLIPS. Well, as we discuss in other aspects of the report, there are some things that can be done within the farm programs themselves, if indeed the objective is to prolong the survival of moderate-sized farms. We come out in the report that targeting of income supports to these size operations, our analysis shows, is very effective in prolonging and making them competitive.

On the other hand, the whole price support mechanism is not as advantageous to the moderate size as it is to the large size. The large-sized farms make out very well on our price support system, and we do say in the report that income support programs for the moderate size, at the exclusion of your very large operations, will help prolong their survival.

But one thing that we do want to caution in our analysis is that these forces that we talked about here today—and more are captured in the report—these forces of technology, change, the economics involved, the institutional arrangements, these forces are so strong in our society that farm programs can either slow this down

or you can make changes that will speed it up, but farm programs will not be able to reverse these trends.

These trends are here, and they are underlying all that we are talking about here today, and that is probably the most important thing for all of us to understand, and that is what these forces are and what are these relationships, and to know that we can do some things, but to think that we can reverse them, it is almost impossible to reverse the forces of change that we see.

Mr. TRAFICANT. Thank you.

Thank you, Mr. Chairman.

Mr. VOLKMER. Thank you.

I recognize the gentleman from Texas.

Mr. ANDREWS. Just to follow up, is it fair to conclude that what you both are saying, in general, is that if the Federal Government does not support the small- and moderate-sized farmers, that those types of farming interests as we know them today in the coming decades will simply disappear from the American scene?

Mr. PHILLIPS. They will disappear to the extent that they will not be able to survive based on income derived from that farm.

You may still have a number of them. They will fall more into what we call our part-time class, where they will rely on income from off-farm sources. They may still be out there on the farm, if someone can bring in that income off the farm so that they can stay there, but as far as their being an economic entity unto themselves, we would answer in the affirmative to your question.

Mr. ANDREWS. You said earlier that agriculture is a different program, and I assume you mean different from other kinds of programs that the Federal Government is involved in. I assume you also mean that in some way it is an important program that makes it different. Is that right?

Mr. PHILLIPS. Yes; what I said was that the agricultural industry is different from other industries. There are unique things about agriculture that you just don't have in other sectors of our economy.

You are dealing here with, for example, a biological industry in which the vagaries of weather and insects and disease—things which to a great extent we cannot control—play a role, so you don't know what your supply is going to be in any one year.

If you have a drought, as we did last year, you can have a crop wiped out. Or if we have a blight, as we did back in the early 1970's, you can also have a very devastating effect on that industry as well as, then, on what that means for consumers.

Mr. ANDREWS. Well, I am kind of grappling with this philosophical issue, and it is sometimes difficult for me to appreciate that the vagaries that affect the agricultural industry, there aren't just as many that affect, say, the savings and loan industry or the manufacturing industry—high interest rates, a burgeoning Federal deficit, some kind of economic disaster in a particular community—that those do not seem dissimilar to the instances that you just mentioned.

I guess the question I really have for both of you is, What makes the agricultural industry unique in that the Federal Government should be supporting these moderate and small farmers? I think, by your testimony, you are saying they are going to disappear as

we know them unless they are supported by the Federal Government.

And doesn't your argument apply equally to, say, the small manufacturer or the small chemical company or a savings and loan business that is trying to make a go against a great big chain or big industry?

Mr. PHILLIPS. Your point is very well taken, and I think you have put your finger on the exact question. I mean, we can argue that agriculture is somewhat different, and that is the whole rationale of why we have had these programs in the past. And there is a rationale there.

But with these changes that we see taking place, many will argue that, well, what is going on here in the agricultural sector is no different than what we see going on in other sectors of our economy. We see the mid-sized kind of company and firm kind of going by the wayside, and large conglomerate operations are really the mainstay in many of our other industries. That is very true.

I think your point about unique is the key to this.

Policymakers, I think, are going to have to make a conscious decision about whether or not this industry is unique, and the answer to that question will go a long way toward determining what, if anything, Congress will do, because if the decision is made that agriculture is not unique, then you let these forces of change run their course, and they will. The handwriting is on the wall as to where we will go. The market forces will determine who stays in and who has to leave, and you will indeed go to an industry in which the very large farms, farms with sales in excess of \$500,000, will be our suppliers of food in the future.

Mr. ANDREWS. I guess my question is, to follow that question with one more, is that bad?

Mr. PHILLIPS. It might even be lower food prices.

Mr. ANDREWS. Dr. Eddleman, is that bad?

Mr. EDDLEMAN. No; I have no judgment that that is bad. Bad connotes an ethical as well as a goodness or a moral thing. I think the key thing that I would say is, as we move in that direction, agriculture does lose its uniqueness.

The only difference between agriculture and, for example, General Motors, if I can use that example, is that agriculture will have a large land base, a small labor base, but also a very high capital base, because agriculture is one of the most capital-intensive industries there is, whereas General Motors supposedly will have a small land base, has had a large labor base—we are not sure about that with all the robotics and electronics that are coming in—but also a high capital base.

In that sense, there will be very little uniqueness to agriculture. It is exposed to the same forces, the economic forces and other forces and the institutional forces, that all the rest of the American economy is exposed to, including worldwide forces.

The only unique thing about agriculture is that it is exposed to the vagaries of nature in terms of weather, disease, and insects, that these other industries are not, plus the fact that even for these large-scale farms, the structure of that industry is such that they are not price-setters. I still believe that automobile and steel and a lot of these other industries can set their prices and com-

mand them. Agriculture, even for the large farms, cannot set their prices. They are still price takers in that respect.

I have no connotation of badness to that. Certainly it is public debate as to whether it is good or bad to let the moderate-sized or smaller scale farms go by the wayside. I think the question is whether or not it is right or wrong with regard to a set of goals and decision rules in society that is going to be followed.

Mr. ANDREWS. Thank you very much.

Mr. VOLKMER. Thank you.

I know you have to be leaving, but I have a short comment I would like to make, and I would like to carry on with what the gentleman from Texas said, because the other implications are social and economic conditions, too, in rural America.

If we accelerate this change—and I agree with Dr. Phillip that the changes are taking place, and you are not going to reverse those. It is just a question of whether we can try to channel that change a little bit and slow it down so we can do other things to adjust.

In regard to what the gentleman from Texas was saying, I would like to point out that as far as I view it and what I see in my own district and, I am sure, other places in rural parts of the United States, if we lose these medium-sized family farms to a great extent and rapidly, then those have implications on my small businessmen, my small towns.

I have got a witness coming from my district on the next panel to tell you about the number of implement dealers, fertilizer dealers, seed dealers, people like this, that are gone from the face.

And so you see a deterioration out there of total rural America, a complete restructuring in the next 15 years of rural America. It affects schools. It affects health care, everything down the line.

And so to say that we are not going to do anything about it, we are just going to let that happen, I am not ready to accept that. To be honest with you, I see that the administration's farm bill would accelerate it, would even make it more rapid because of the decline in prices immediately.

Personally, I am not prepared at this time to say no, we are just going to let it happen; we are not going to do anything about it. I would rather give it more time and see if we can work something out.

The last thing I would like to say—the gentleman from California would like to say a few words, too—but the last thing is, in the timeframe, maybe food prices may decline a little bit if you have the larger ones all of a sudden, the bigger ones, and they may be able to do it for less. By this, I think we have also seen that things could change.

We know there are going to be changes like in dairy, and eventually, maybe in 10 or 15 years, instead of having 12,000 average pounds a year in milk per cow, you are going to run up to 19,000 or 20,000. Maybe we are going to have milk from the Southwest or Florida or upstate New York shipped all over the United States. That may be the case.

But I think that my people right now in parts of the Midwest would like the idea that they may be able to get milk locally and

not worry about it being transported through the wintertime sometimes from those great distances, too.

So I would say that there is definitely a uniqueness in agriculture as it applies not only just to that family farm, but the total of the family farms and how that applies to total rural America.

So I appreciate your study, and I would like to say, as a member of the Agriculture Committee, that it is going to be very helpful to us.

The gentleman from California.

Mr. PACKARD. Thank you, Mr. Chairman.

I appreciate very much not only your testimony this morning but your study. I read it carefully and with great interest, having come from a farm myself.

This country has gone through an industrial revolution in the past 100 years that at one time many people thought would eliminate small business, and yet today 85 percent of American business is small business.

I think we are going through an agricultural revolution now and have been for some while. I suspect, myself, that the small- and mid-sized farmer will still be around in this country, not because of the economic advantages of small- and mid-sized farming. It never has been there.

When I was born and raised on a farm years ago, that was not the incentive that we made us stay on the farm. There are other extremely important incentives to be on a farm in America. The whole atmosphere, the raising of family, and the whole feeling there is a very attractive thing, and so the outside income will constantly be there, I think, to preserve the small- and mid-sized farm.

We are never, economically, going to make it competitive with big farming or agribusiness or any other business, for that matter. It simply has not been there in the past and will not be there in the future, in my judgment.

It would be a sad mistake for Government to regulate farming to the point where they try to make it equal, and that is what Government regulation tends to do. It tries to equalize the inequalities in any business or any program, and I just don't see that as a viable alternative. I would much prefer to see the Government look for data information that they can make available to the farmers as to productions, nationwide and international needs for certain crops, and so forth.

Giving them information as to when and what to plant perhaps, would be more effective than trying to regulate prices and the amount of crop that you can plant, and so forth. We were raised on a small farm, only 40 acres. It supported, though, with some help of outside income, a large family. The last thing my father wanted as a farmer was the Government telling him how much he could plant on that 40 acres and what price he would get.

That is not what our farmers that I am hearing from want. They want the marketplace to be able to work its will, and they can live with that.

Thank you very much.

Mr. VOLKMER. Dr. Phillips and Dr. Eddleman, I thank you very much for being here.

We will have additional questions. I have a lot more to ask. We will submit those to you in writing, and we would appreciate your written response for the record on those. Any other members who wish to submit written questions may send them to the staff, and we will get them to you.

Mr. VOLKMER. Thank you very much for being here. We appreciate it very much.

I know you have to go on now to the Senate for some duplication.

Our next panel consists of Dr. Charles Kidd, dean of the College of Engineering Science, Technology and Agriculture from Florida A&M University; and Mr. Donald W. Shelton, a constituent of mine and farmer from north of Centralia, MO, Audrain County.

We will first hear from Dr. Kidd. You may review your prepared statement or summarize, however you so desire. Your prepared statement will be made a part of the record in full.

Dr. Kidd.

STATEMENT OF DR. CHARLES C. KIDD, DEAN OF THE COLLEGE OF ENGINEERING SCIENCES, TECHNOLOGY AND AGRICULTURE, FLORIDA A&M UNIVERSITY

Dr. Kidd. Thank you very much, Mr. Chairman.

As you have heard, I am Charles Kidd, dean of the College of Engineering Sciences, Technology, and Agriculture at Florida Agricultural and Mechanical University in Tallahassee, FL.

It is certainly a privilege to appear before you today to testify on the role of universities in the development of technologies that will be helpful to small- and moderate-sized farms.

Agriculture is Florida's oldest and largest industry. The economic and nutritional welfare of Floridians depends upon the State's agricultural industry. Seventy to seventy-five percent of Florida's 44,000 farms are classified as small farms. According to a 1980 Census of Agriculture, approximately 60 percent of the small farm population in the State of Florida is concentrated in central, northern, and northwestern areas of the State.

Of these farmers, 56 percent have holdings of less than 50 acres; 36 percent have gross sales of less than \$2,500 annually; and 62 percent have gross sales of less than \$10,000 annually. These farmers are in need of assistance in terms of agriculture and marketing technology.

A small farm has been defined as any farm producing family net income from all sources, farm and nonfarm, below the median non-metropolitan income of the State; operated by a family dependent on farming for a significant, though not necessarily a majority, of its income; and on which family members provide most of the labor and management.

The small farmer in Florida is experiencing difficulties because of the rising cost of technology, marginal profits, land costs, and the loss of agricultural land to development.

Recent trends in the overall economy of the Nation have put many of the small farmers in a situation of extreme economic stress. Small-scale farm operations and limited resource production systems are recognized to be important to the future of agriculture and the quality of rural life in the State of Florida.

What happens to family farms and farm families in the United States in the next 25 to 50 years could have a significant impact upon food and fiber supplies and on the well-being of people of the Nation and the world.

With these problems in mind, the 1981 Florida legislature enacted legislation establishing and funding the Governor's Conference on the Future of Small Farms in Florida. The purpose of the conference was to gather information from persons who operate small farms and from other agricultural experts, to be used to develop recommendations which will lead to the continuation and survival of small farms in Florida.

The problems identified by the small farm operators in north and northwest Florida include: high cost of equipment and supplies; high cost of energy; efficient production management of vegetables, crops, fruits, and livestock; marketing of produce; pest control; and farm fiscal management.

These small farmers, many of them black, derive their income from growing corn, soybeans, peanuts, vegetables, small fruits, melons, and pecans. The principal livestock enterprise of most of the small farmers is swine, with a small number of them having beef herds ranging from 5 to 25 heads.

Many small farm operators continue to live in poverty. Such farms are prime candidates for additional agricultural research and extension efforts. Such full-time or part-time small farm operators need to be approached with a broad range of options for developing farming systems that are profitable in the present-day economy.

The problems of small farmers have not received enough attention in the past. It has been pointed out by many workers that the problems that small farm operators face are different from those of large-scale producers. These problems need to be addressed urgently for continuation of viable agricultural business in the State of Florida.

Florida A&M University, a historically black land-grant institution, has been involved in rural development and small farm improvement efforts and instructional and extension programs in the division of agricultural sciences that are targeted toward assisting these limited-resource small farmers.

Continuing development of electromechanical, biological, and informational technologies tends to promote more efficient operations on large-scale agricultural entities, while simultaneously compounding the problems of survival for moderate and small farms operating.

There is no scientific barrier to the profitable utilization of these new technologies for small farm operators. However, the cost of acquisition and appropriate application is quite prohibitive for this group of farm operators.

Therefore, the service role is well defined for Florida A&M University and other land-grant institutions committed to helping moderate and small family farm operators. We must be effective, low-cost agents in the transfer of modern technology to small farm operators. To do this requires that FAMU and other institutions modify their delivery systems for efficiency and greater impact of

teaching, research, and extension expertise on the problems which adversely affect small farm operations.

Florida A&M University is attempting to meet these urgent needs through the Center for Small-Farm Production Systems, an integrated research, evaluation, and extension unit which focuses on the resolution of technological and economic problems of immediate and long-range concern to small farmers.

Our approach recognizes the need for change agents to command state-of-the-art knowledge and, at the same time, maintain the effectiveness of our historic personal approach to helping farm families.

We have, during the first stages of our retooling, managed to effectively integrate our ongoing Federal and State financial resources in support of our small farm development efforts. We fully recognize that our current resources are not adequate, and we are therefore in search of additional resources, Federal, State, and private, to support the effective upgrading of existing scientific skills; to acquire additional specialists, such as biotechnologists, information scientists, engineers; to complete physical plant modifications; and to equip informational exchange work stations.

We are optimistic that our efforts and the efforts of other land-grant institutions will help bring this important aspect of American life into the 21st century.

Thank you.

[Statement of Dr. Kidd follows:]

Statement
of
Dr. Charles C. Kidd, Sr.
Dean, College of Engineering Sciences, Technology
and Agriculture
Florida A&M University
Tallahassee, FL 32307
Before the
of the
Committee on Science and Technology
U. S. House of Representatives

Introduction

Good morning. I am Dr. Charles C. Kidd, Dean of the College of Engineering Sciences, Technology and Agriculture, Florida Agricultural and Mechanical University, Tallahassee, Florida. It is a privilege to appear before you today to testify on the role of universities in the development of technologies that would be helpful to small and moderate size farms.

I. BACKGROUND

American farms have declined in number for nearly half a century. The highest decline was during the 1950's. Since then, the percentage of large and moderate-sized farms has increased dramatically nationwide from 8 percent in 1960 to 34 percent in 1968. Such rapid increase in large and moderate-size farms has often been at the expense of several small-farms which are being abandoned in increasing number due to lack of adequate return on investment as well as lack of incentives for farmers to stay in business. Agricultural practices have become much more mechanized. Since 1940, agricultural product values have quadrupled while the number of agriculture producers has decline by four-fifths.

The plight of the small-farm operator in the United States in general, and in the State of Florida in particular, is well-documented. However, only in recent years has the actual impact of this plight on the quality of life in Rural America begun to be appreciated.

As the small-farm operators go out of business, commerce in the area dries up and schools and religious organizations close down, i.e., the social fabric of Rural America disintegrates. These displace people contribute to the population below the poverty line and tax the states, county and federal delivery system in Education, Health and Welfare, not to speak of the immense cost in human terms in the loss of pride and selfworth.

However, many small-farm operators continue to live in poverty. Such farms are prime candidates for additional agricultural research and extension efforts, due to their limited resources and low production. These full-time small farm operators and some part-time operators need to be approached with a broad range of options for developing farming systems that are profitable in present day economy.

Application of appropriate agricultural technology and marketing methods

may help some farmers, but the overall package of assistance must include a broad range of research and service programs ranging from crop production to human resource development to other programs for those unable to earn a decent living through small-farm operation.

A concentrated effort is needed now to find and disseminate effective solutions to the problem of Florida's small farmers.

II. The Florida Situation

According to 1970 Census of Agriculture, approximately 60 percent of the small farm population in the State of Florida is concentrated in central, northern and northwestern areas. Many of these farmers have holdings of less than 50 acres and gross sales less than \$2,500 and are in need of assistance in terms of agriculture and marketing technology.

Florida A&M University, a Land-Grant Institution, is in a unique position, not only geographically but also traditionally, to make a significant contribution in agricultural instructions, research, and extension activities meeting the needs of limited resourced farmers. Several past and present projects have made significant contributions and have had a direct impact on small-farm operation and rural life in general. These projects include: Nutritional Diets for Senior Citizens; Vegetable Production on Small-Acreage Farms; Pasture Management; Cow/Calf Operations; Experimental Low-Cost Housing; and Farm Marketing and Grape Production as a "Pilot Commodity" for small-farms in the State of Florida.

In 1978, the legislature, responding to the needs of Florida's grape growers, provided find to establish a Center for Viticultural Science at Florida A&M University. This ongoing program is involved in grape research and production practices beneficial to small-farm operators.

Since 1975, the FAMU Cooperative Extension Service unit has received support from the USDA to provide services to limited resource farms their

owners in an effort to alleviate problems inhibitory to their economic viability. This service has been a joint effort between FAMU and University of Florida-IFAS Extension Service, with most of the effort being performed off-campus directly in the farmer's field. To date, more than 2,500 farmers have been served. Currently, this specific service is provided only in six counties located in Central and Northwest Florida (Columbia, Jackson, Leon, Manatee, and Sumter) because of limited funding. Many more needy farmers have not received any services.

Thus, it is evident that Florida A&M University has a broad base of agricultural instruction, research, and extension programs that can be immensely effective in reaching the small-farm operator and limited resources farmers in the Central, Northern, and Northwestern parts of the state.

III. Meeting Future Needs

Extension efforts have shown that an approach specialized for small farms is needed to address the problems of the small farm and that rapidly changing technologies require extension specialists to be knowledgeable of new techniques and materials and their effectiveness.

The FAMU Agricultural Advisory Council has therefore recommended the establishment of an integrated research-farm unit designed to address the problems of Florida's small farm operators by a coordinated research, instructional, and extension efforts will help meet the needs of these small farmers.

FAMU has in the interest, commitment and some resources (people, land, equipment, basic structures, and annual support) to initiate a comprehensive effort on the problems of small farmers through the establishment of a Center for Small-Farm Production Systems.

A. Technology Transfer; The Center for Small-Farm Production Systems:

FAMU is committed to make an even greater contribution to the socio-economic viability of small farmers. This commitment is based upon the strategy

to unify pertinent instruction, research, and extension efforts into a concerted approach through the establishment of a "Center for Small-Farm Production Systems" on its present 125-acre campus farm site. The establishment of this Center will serve the needs of small farmers and at the same time strengthen FAMU's agricultural programs.

1. To serve the State of Florida as the focal point of instruction, research, extension and technology transfer for small-farm operations;
2. To assist in coordinating the expertise of state, local and federal agencies, private organizations and individuals for addressing problems of small farmers and survival of the rural family unit;
3. Involve extension personnel in technology development and evaluation and to better facilitate their efforts to disseminate information relevant to small-farming systems;
4. To identify and facilitate the development and evaluation of needed technologies and activities for small-farm production systems and to encourage and assist in the adoption of existing unused information; and
5. To contribute to the continuing education of small farmers through workshops, training programs and improved access to the vast pool of relevant agricultural information.

B. Research Activities to Be Undertaken at the Center for Small-Farm Production Systems at FAMU:

The main research objective of the proposed Center is to investigate various production and management problems of the small-farm operator and provide appropriate solutions to increase his overall economic output. Since each small-farm operator has a unique combination of land, crops, livestock

and other activities, two basic approaches will be used:

1. Survey his/her present small-farm operation and find ways to maximize current production (crops, livestock, vegetables, etc.) and increase family income; and
2. Research additional activities that a small-farm operator can profitably undertake.

The projected activities for small-farm systems under the Center include:

- a. Crop production and soil management research.
- b. Forage production.
- c. Livestock production.
 - Beef cattle production, cow/calf operation.
 - Swine production and management.
 - Other small farm animal management (goats, rabbits, etc).
- d. Small-scale poultry and fowl production.
- e. Grapes and other fruits.
- f. Vegetable production and community garden plots.
- g. Pest management research.
- h. Special income-producing activities (aquaculture, Christmas trees, etc).

C. Some research projects at the Center for Small Farm Production Systems at FAMU.

1. Prescribing Soil Fertility Needs of Small-Farm Operations

Crop production and yields are directly linked to soil fertility and management. In order to achieve relatively higher yields or quality, most small-farm operators have to invest a large portion of their input into fertilizers and/or lime. However, to do this effectively, the farmer needs to estimate the crop response in terms of application of the different nutrient elements for maximum profit.

The goal of the soil fertility evaluation and improvement program will be to obtain soil information and to transmit that information to small-farm operators to guide them in the "proper" use of fertilizers, lime and soil amendments. This information will be transmitted rapidly with a minimum of cost involved and will be custom-tailored for small-farm operators.

The following activities will be included in this project:

- a. Establish a soil testing and soil fertility evaluation laboratory at FAMU.
- b. Based on the results of soil fertility evaluation, advise small-farm operators in the most beneficial use of fertilizers, lime, and other soil amendments.
- c. Conduct soil fertility trials at FAMU model farm and on demonstration sites to obtain more information on soil fertility and management problems of small-farm operators in the State of Florida.

2. Meeting Livestock Needs of Small-Farm Operations

Most of the small-farm operators are engaged in some sort of livestock production. The needs vary from forage production to marketing. The following activities will be undertaken by the Center in this area:

- a. Improved forage production: cultural practices, management, economics, and storage.
- b. Effective use of forage species.
- c. Efficient cattle production under different grazing conditions.
- d. Legumes.
- e. Cow/calf operation.
- f. Small farm animals (goat, swine, turkey and poultry).
- g. Cost analysis and marketing.

3. Meeting Needs of Small-Farm Operations in the Area of Vegetable and Fruit Production.

The production of vegetable crops and fruits is generally dictated by market demand. However, a typical farm operator in Florida may grow: beans, cucumbers, eggplants, greens, melons, okra, onions, peppers, squash, sweet corn, and tomatoes. The most frequently mentioned problem of small-farm vegetable growers is marketing. Because of the high transportation cost and perishable nature of

commodities, the potential for market development needs to be thoroughly investigated. Other problems in this area range from soil fertility to planting time, varieties, and management practices. The Florida A&M University Extension Program is already involved in vegetable variety and soil fertility trials at the FAMU farm. Also, community vegetable garden plots are made available to the citizens year around. The following activities will be undertaken by the Center in this project:

- a. Conduct research on selected vegetable crops and transmit pertinent information to the small-farm operator.
- b. Provide answers to the problems of the small-farm vegetable producer in terms of agronomic practices, pest management, and marketing.

Fruit crops that need attention are: strawberries, blueberries, blackberries, and grapes. Fruit trees include: peach, pear, persimmon, and apples.

- a. Research various fruit crops and deciduous fruits that can be economically produced on small-farm operation systems.

4. Meeting Pest Management Needs of Small-Farm Operations

The reduction in yield and quality of produce by insects, weeds, and plant diseases may be the single most important factor which may determine whether the small-farm operator will make a profit or will suffer a loss. Since a small-farm operation includes agronomic crops, vegetable crops and possibly fruit crops, pest management is more difficult in comparison to a single crop farm. The following activities will be undertaken in this area:

- a. Research effective insect control methods applicable to small-farm operations.

- b. Research efficient and economic weed control methods for small-farms.
- c. Research controls for plant diseases common to small-farm operations.

5. Marketing Structure and Efficiency

A large portion of the problems of small farmers is related to marketing. The small farmer encounters a marketing system that is not organized to handle his small volume of produce in terms of transportation, storage, processing and sale. Market studies are needed to seek "pocket" within the existing large system where the small producer can successfully participate.

Objectives:

- a. To document the barriers to small-farm production in Florida.
- b. To identify markets with special emphasis on seeking new organizations where small producers can effectively compete.

6. Special Income-Producing Activities

This group included those activities that can be added to an already existing small-farm operation and requires a minimum of capital outlay. The main feature of these activities should be that they will provide extra income to the operator with minimum investment of time, labor and capital. Examples are aquaculture, Christmas tree production, nutritional needs of small-farm marketing, and utilization of current by-products.

7. On-Site Demonstration Activities

The Center for Small-Farm Production Systems at Florida A&M University will undertake demonstration activities in various areas of research which are beneficial to the small-farm operator. The

purpose is to maintain and demonstrate good management practices in areas of crop production, livestock production, vegetable and fruit production, etc. that are accessible to the public at large and small-farm operators in particular. These demonstrations on the actual site will represent the total integrated approach of various research and extension workers.

E. FAMU Cooperative Extension Service Unit for Small-Farm Production Systems

This unit will be integrated into the total small-scale agricultural production system concept to strengthen the small-scale farm research, extension, and instructional efforts of the University. The primary focus of the Extension Unit is to develop the educational delivery component including packets, kits, slide sets, visuals, and related educational materials from the research programs included in the systems approach. Educational materials developed from the small-scale production systems in the Center will be used by extension personnel in the county units to inform small-scale farmers, rural residents, and limited resource farmers of alternative cash crops, technology, marketing strategies, and managerial skills in order to increase income from their operations.

To date the delivery process of the FAMU Extension Programs has been restricted to the use of only agricultural technicians as a team in county offices to disseminate educational information derived from research and by the use of on-farm crop/vegetable demonstration plots, where a one-acre tract of land belonging to a farmer is planted and cared for according to recommendations of extension agents. It is perceived that the proposed small-scale farming concept and Center will greatly enhance these extension

off campus outreach efforts.

The objectives of the extension component of the FAMU small-scale farming systems Center are:

1. To identify small-farm owners in surrounding counties who may be interested in alternative small-farming enterprises.
2. To establish demonstration projects, accessible to small farmers, that serve to encourage adoption of low-energy technology and alternative cash crops (demonstration results obtained at the Center for Small-Farm Production Systems will serve to initiate off-campus projects).
3. To develop and provide educational materials in the form of simplified fact-sheets, pamphlets, and brochures developed by researchers and extension specialists at FAMU and cooperating individuals/agencies.
4. To conduct periodic training sessions, group meetings, field tours and seminars which are related to small farmers and efforts proposed for the Center for Small-Farm Production Systems at FAMU.

Summary

Agriculture is Florida's oldest and largest industry. The economical nutritional welfare of Floridians depends on the state's agricultural industry. Seventy to seventy-five percent of Florida's 44,000 farms are classified as "small-farms". According to 1980 Census of Agriculture, approximately 60 percent of the small farm population in the State of Florida is concentrated in Central, Northern, and Northwestern areas. Of these farmers, 56 percent have holdings of less than 50 acres, 36 percent have gross sales less than \$2,500 and 62 percent have gross sales less than \$10,000. These farmers are in need of assistance in terms of agriculture and marketing technology.

A small farm has been defined as any farm (1) producing family net income from all sources (farm and non-farm) below the median non-metropolitan income of the State (2) operated by a family dependent on farming for a significant though not necessarily a majority of its income; and (3) on which family members provide most of the labor and management.

The small farmer in Florida is experiencing difficulties because of the rising costs of technology, marginal profits, land costs and the loss of agricultural land to development. Recent trends in the overall economy of the nation have put many of the small farmers in a situation of extreme economic stress.

Small-scale farm operations and limited resource production systems are recognized to be important to the future of agriculture and the quality of rural life in the State of Florida. What happens to family farms and farm families in the United States in the next 25 to 50 years could have a significant impact on food and fiber supplies and on the well-being of the people of the nation and the world.

With these problems in mind, the 1981 Florida Legislature enacted legislation establishing and funding the Governor's Conference on the Future of

Small Farms in Florida. The purpose of the conference was to gather information from persons who operate small farms and from other agricultural experts, to be used to develop recommendations which will lead to the continuation and survival of small farms in Florida.

The problems identified by the small farm operators in North and Northwest Florida included:

1. High cost of equipment and supplies;
2. High cost of energy;
3. Efficient production/management of vegetables, crops, fruits, and livestock;
4. Marketing of produce;
5. Pest control; and
6. Farm fiscal management.

These small farmers, many of them black, derive their income from growing corn, soybeans, peanuts, vegetables, small fruits, melons and pecans. The principal livestock enterprise of most of the small farmers is swine with a small number of them having beef herds ranging from 5 to 25 heads.

Many small farm operators continue to live in poverty. Such farms are prime candidates for additional agricultural research and extension efforts. Such full-time or part-time small farm operators need to be approached with a broad-range of options for developing farming systems that are profitable in the present day economy.

The problems of small farmers have not received enough attention in the past. It has been pointed out by many workers that the problems that small farm operators face are different than those of large scale producers. These problems need to be addressed urgently for continuation of viable agricultural business in the State of Florida.

Florida A&M University, an historically black land-grant institution, has been involved in rural development and small farm improvement efforts and

instructional and extension programs in the Division of Agricultural Sciences, that are targeted towards assisting the limited resources/small farmers.

Continuing development in Electromechanical, Biological and Informational Technologies tend to promote more efficient operations on large scale agricultural entities while simultaneously compounding the problems of survival for moderate and small-sized farm operators. There is no scientific barrier to the profitable utilization of new technologies for small farm operations. However, the costs of acquisition and appropriate application is quite prohibitive for this group of farm operators. Therefore, the service role is well-defined for FAMU and other land-grant institutions committed to helping moderate and small family farm operators. We must be effective, low-cost agents in the transfer of modern technology to small farm operators. To do this requires that FAMU and other institutions modify their delivery systems for efficiency and greater impact of teaching, research and extension expertise on the problems which adversely effect small farm operations. Florida A&M University is attempting to meet these urgent needs through the Center for Small-Farm Production Systems, an integrated research/evaluation/extension unit which focuses on the resolution of technological and economic problems of immediate and long-range concern to small farmers. Our approach recognizes the need for change agents to command state-of-the art knowledge and at the same time maintain the effectiveness of our historic personal approach to helping farm families. We have during the first stages of our re-tooling effort managed to effectively integrate our on-going federal and state financial resources in support of our small farm development efforts. We fully recognize that our current resources are not adequate and are therefore in search of additional federal, state and private support in order to effect the up-grading of existing scientific skills, acquire additional specialists (Biotechnologists, Information Scientists, etc.) complete physical plant modifications, and equip our information exchange workstation. We are optimistic that our efforts and the efforts of other land-grant institutions will help to bring this important aspect of American life into the 21st Century.

RESUME' for Charles C. Kidd, Sr., Ph.D., P.E.,
Florida A&M University

Dean and Professor, College of Engineering Sciences, Technology and Agriculture since November 1, 1977

Born: August 9, 1936, at Washington, D.C.
Graduated from Armstrong Technical High School, Washington, D.C., Majoring in Engineering, College Preparatory Program.
Received a B.S. Civil Engineering from Case Institute of Technology, Cleveland, Ohio, June 1958.
Received a M.S. Sanitary and Industrial Hygiene Engineering from the University of Michigan, June 1964.
Received a M.S. Radiological Health from the University of Michigan, August, 1967.
Received the Ph.D. in Environmental Health Sciences from the University of Michigan, 1970.

Prior Positions:

Civil Engineer I, Ohio State Highway Department
Sanitary/Industrial Hygiene Engineer, 5th Epidemiological Flight, USAF, Japan

Military

Military Public Health Officer, USAF Hospital, Tachikawa Air Base, Japan
Bioenvironmental Engineer, 810th Medical Group, Fairchild Air Force Base Spokane, Washington.

Assistant Professor, Environmental Health, School of Public Health, University of Michigan.

Assistant Vice President, Office of Student Services, University of Michigan.

Associate Director of Environmental Programs, State of Illinois Board of Higher Education

President, Olive-Harvey College, Chicago, Illinois.

Vice President for Administration, Chicago State University.

Vice President for Neighborhood Development, South Shore National Bank, Chicago, Illinois

Consulting:

Polytech Inc., Cleveland

COMPRAND Inc., Chicago

Environment Seven Inc., Chicago

Office of Technology Assessment, U.S. Congress, Washington, D.C.

Committee on Civil and Environmental engineering, NSF, Washington, D.C.

Memberships:

Alpha Phi Alpha Fraternity Inc.

American Public Health Association

American Society for Engineering Education

FAMU Agricultural Association

University Representative to:

The South East Consortium for International Development

The Association of U.S. Naval ROTC Colleges & Universities

The Governor's Task Force on High Technology and Service to Industry

Mr. VOLKMER. Thank you very much, Dr. Kidd.

Before we go to questioning, we will now hear from Mr. Shelton. Donnie.

**STATEMENT OF DON SHELTON, GRAIN FARMER AND OWNER,
SHELTON SEED, CENTRALIA, MO**

Mr. SHELTON. I am representing a rural area from Audrain County here. I will start by giving you a little background on myself and what I do in my operation.

My name is Donnie Shelton, and I would like to thank you all very much for the opportunity to testify here today. I live in Centralia, MO, a farming community with a population of approximately 3,535.

I grew up on a farm north of Centralia and began farming in earnest at age 12 when my father died of a heart attack. My mother and I farmed 200 acres together.

In 1967, I began helping Elmer Kollman with his seed raising and cleaning operation. In 1970, while still working for Mr. Kollman, I began raising my own certified seed. My wife Joy and I bought a 400-acre farm north of Centralia in 1974. I built my own seed cleaning plant which became operational in 1978. I rent an additional 320 acres on which I raise seed and also clean seed for other farmers.

Seed cleaning is completed in two basic operations. First, the seed is poured into a large hopper and through a screen which culls out foreign matter and odd-sized seed. Next, the seeds go through a spiral gravity separator which takes out broken seeds, small-sized seeds, and odd-shaped seeds. The result is seed that is of a fairly uniform size and shape. It is seed that is easy to plant.

In a final operation, seed can be treated with a systemic fungicide to protect the seed against seed-borne and soil-borne diseases. All seed is not treated because it does add a cost to the price, and quite frankly, some farmers cannot afford to pay it, even though it means better yields.

I would like to have these brochures passed out.

The two products we use in our area are Vitavax and Apron, which will increase the yield 2 to 5 bushels. The technology is there, but the average farmer, when he comes in to get his seed cleaned and treated, if he does have it treated, he doesn't feel that he can pay the extra cost per bushel. It adds \$3.50 per bushel to do these two things, which is a cost up front which he feels he just cannot afford to pay.

I buy foundation seed from the department of agronomy at the University of Missouri, Columbia. The department raises foundation seed from breeder seed. New varieties of breeder seed are being developed each year by the department.

From the foundation seed, I raise registered seed. The registered seed is planted to produce certified seed. The closer a farmer gets to the breeder seed, the stronger the seed is. It has more vigor, vitality, and can produce more bushels per acre.

I raise soybeans and wheat for certified seed and also raise my own private line of soybean seed, Shelton seeds. They are an exclusive line, not sold anywhere else. They are a good bean for drilling.

I also sell other brands retail, but the bulk of my sales are wholesale to various farm suppliers and exchanges. Through the year, I deal with approximately 250 customers. I also deal through brokerage houses, and they act as a middleman between the farmer and myself.

My 7,200-square-foot building is where I have my seed-cleaning operation. I designed and built the plant, and since then, eight other plants have been copied from it. It is a small, efficient plant. The seed-cleaning equipment takes up only a small portion of the building. The majority of the space is used to store the seed that I have cleaned and bagged.

I store about 25,000 bushels of seed in the building. I hire one part-time and two full-time workers to operate the seed-cleaning machinery. The workers also help customers and keep track of the various lots of seed.

Raising certified seed involves a lot of recordkeeping. You have to keep each lot of seed separate. A lot is approximately 1,000 bushels of one variety of seed.

The Missouri Seed Improvement Association, located on the University of Missouri, Columbia campus, has to inspect the fields where each lot of seed is grown and also check the germination of each lot of seed and issue tags indicating the percentage of germination. The tags are issued on the bags of seed, and then they are applied to the bags when they are distributed.

In storing the seed once it is cleaned, myself and the employees must keep track of the various lots and to whom they are sold. In addition to this type of recordkeeping, I also keep records on the type of foundation seed bought, when and where planted, how many bushels were planted, and the yield.

Medium-sized soybean seeds have about 26,000 seeds per pound. About 150,000 seeds should be planted, which means a farmer should buy about 53 pounds of seed per acre.

My wife Joy runs the forklift and helps with the bookwork when no one else is around, whenever I am gone. She used to help a lot more but is busy now. We have three children, so she spends most of her time with that.

Our operation last year cleaned approximately 100,000 to 125,000 bushels.

Technology improvements available today in the seed-cleaning business include a computerized cleaning system which would not only make for a more efficient operation but also improve the quality of the seed. In the packet there that I gave you, it has got a description. It is a computerized system that goes onto the machine, and it is very efficient. It will save 2 to 6 percent of the seed that is cleaned and taken out and taken to the elevator and sold.

But the cost is prohibitive for an individual such as myself to use this. There are only six in the United States in operation right now. The cost of it is \$7,200 for the hardware and \$32,000 for a 5-year lease on this, and it just a lease. So it is prohibitive in an operation such as mine. It would take about 500,000 bushels to be feasible for me to do something like this.

However, the cost of this system is prohibitive to my operation, even though the farmers planting the seed would benefit from the seed by increased yields. Modern technology is available, but the

bottom line is that the cost must be brought in line with what the farmers can afford to pay.

I would also like to have on record that in our area the farmers are having a very tough time. We have had three machinery dealerships go out in the last 2 years. Two fertilizer dealers have closed down, one car dealership, and one packing plant have closed in the last 2 years.

The farmers are really having a tough time at this time, still trying to get operating money to make everything go for this coming year.

This concludes my presentation, and I thank you for the opportunity.

Mr. Chairman, if you or the committee have questions, I will take them at this time.

Thank you.

[The prepared statement of Mr. Shelton follows:]

Shelton Seed

TESTIMONY PRESENTED BEFORE THE U. S. HOUSE OF REPRESENTATIVES SPACE AND TECHNOLOGY COMMITTEE, SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS, ON TUESDAY, MARCH 19, 1985
BY DON SHELTON, ROUTE 2, BOX 237, CENTRALIA, MISSOURI 65240.

My name is Don Shelton and I would like to thank you very much for the opportunity to testify here today. I live in Centralia, Missouri, a farming community with a population of approximately 3535.

I grew up on a farm north of Centralia, and began farming in earnest at age 12 when my father had a heart attack. My mother and I farmed 200 acres together. In 1967 I began helping Elmer Kollmann with his seed raising and cleaning operation. In 1970, while still working for Kollmann, I began raising my own certified seed. My wife Joy and I bought our own 400 acre farm north of Centralia in 1974. I built my own seed cleaning plant which became operational in 1978. I rent an additional 320 acres on which I raise seed and also clean seed for other farmers.

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In a final operation, seed can be treated with a systemic fungicide to protect the seed against seed borne and soil borne disease. All seed is not treated because it does add a small cost to the price and quite frankly some farmers can't afford to pay it, even though it means better yields.

I buy foundation seed from the Department of Agronomy at the University of Missouri - Columbia. The department raises foundation seed from breeder seed. New varieties of breeder seed are being developed every year by the department. From the foundation seed I raise registered seed. The registered seed is planted to produce certified seed. The closer a farmer gets to the breeder seed, the stronger the seed is. It has more vigor, vitality and produces more bushels per acre.

I raise soybean and wheat for certified seed and also raise my own private line of soybean seed, Shelton Seeds. They are an exclusive line, not sold anywhere else. They're very good for drilling. One line of Shelton Seeds stand approximately 38 inches tall when the plant is mature. The other produces a plant approximately 40 inches tall. I will sell Shelton Seeds to anyone who wants to buy. I also sell my other brands retail, but the bulk of my sales are wholesale to various farm suppliers and exchanges. I also sell some through brokerage houses that act as middle man between the farmer and myself.

My 7200 sq. ft. building houses the seed cleaning operation. I designed and built the plant, and since then, eight other plants have been copied from it. It's small, nothing big or fancy, but it's efficient. The seed cleaning equipment takes up only a small portion of the building. The majority of the space is used to store seed that has been cleaned and bagged. I can store 25,000 bushels of seed in the building. I hire one part-time and two full time worker to operate the seed cleaning machinery. The workers also help customers and keep track of the various lots of seed.

Raising certified seeds involves a lot of record keeping. You have to keep each lot of seed separate. A lot is approximately 1,000 bushels of one variety of seed.

The Missouri Seed Improvement Association located on the University of Missouri - Columbia campus has to inspect the fields where each lot of seed is grown, and also check the germination of each lot of seed and issue tags indicating the percentage of germination. The tags are used on the bags of seed.

In storing the seed once it's cleaned, myself and the employees must keep track of the various lots and to whom they are sold. In addition to that type of record keeping, I must also keep records of the type of foundation seed bought, when and where planted, how many bushels were planted and the yield.

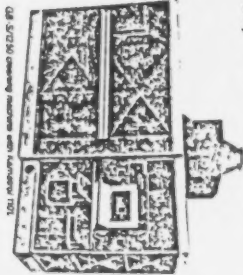
Medium-sized soybean seeds have about 2,600 seeds per pound. About 150,000 seeds should be planted per acre which means a farmer should buy about 53 pounds of seed per acre.

My wife Joy runs the fork-lift when no one else is around. She used to help a lot more, but is busy taking care of our three children. Our operation last year cleaned approximately 100,000 to 125,000 bushels.

Technological improvements available today in the seed cleaning business include a computerized seed cleaning system (see attachment) which would not only make for a more efficient operation, but also improve the quality of the seed. However, the cost of this system is prohibitive to my operation, even though farmers planting the seed would benefit from the seed by increased yields. Modern technology is available, but the bottom line is that the cost must be brought in line with what the farmer can afford to pay.

Thank you again for allowing me the opportunity to testify before your committee, and I would be happy to answer any questions.

Kamatrol System



UD 50250 cleaning machine with Kamatrol 101.

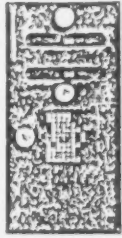
With Kamatrol, Kamax introduces an entirely new and revolutionary technique for cleaning and sorting grain and seed. Kamatrol provides advanced "smart" electronic control and supervision of the whole cleaning process. It helps the operator by efficient control of the machine's work much easier and more efficient. Kamatrol simplifies process control, minimizes wastage and delivers a better end product. In short, it makes the operation more economical.

The Kamatrol is pre-set and operates automatically. It can be easily adjusted to influence the control functions at its discretion. The Kamatrol can be linked to a computer with a terminal and/or printer to allow central supervision and documentation of the process.

The Kamatrol is a robust and dependable system. It is built to last and is not affected by dust, moisture, temperature or other environmental factors. The Kamatrol is easy to use and is built to run round the clock with unvarying reliability.

Computerized Seed-cleaning system

An entirely new technique



The Kamatrol™, developed from scratch by Kamax, offers enormous technical and economic advantages in the cleaning and sorting of grain and seed.

The method used up to now for controlling the process and adjusting machine settings, some simple mechanical aids. It consists simply in taking a handful of material as a sample and using it to estimate and adjust the setting of the aid on the screen. This method is very time-consuming and varies widely. The operator cannot be present all the time to make the checks and adjustments. The influence of the process on the results, which may thus be very different, is not taken into account. It is necessary to blow such a wide margin of safety that losses of prime product with the loss of quality are inevitable. The Kamatrol™ monitors the process continuously, efficiently eliminating the drawbacks of the manual method and optimizing the cleaning operation.

Yield

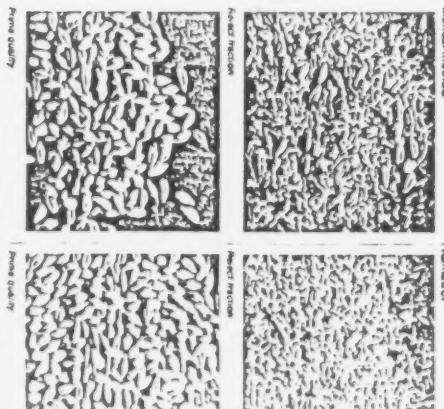


Kamatrol is the first of a new generation of cleaning and sorting systems.

Advantages of Kamatrol™

1. On the pre-cleaning machine
Lower drying cost.
Better drying effect.
2. On the fine cleaning machine
Higher yield of prime product.
Fewer losses of product due to dust and removed.
Higher productivity per unit.
Higher machine capacity.
Lower wear and tear.
Lower energy costs.
3. Grading of brewing barley
Higher yield.
Higher quality.
Always gives the desired grading result.

Much better economy



The Kamatrol ensures that no prime quality product is lost with the reject. It gives better quality and a lower cost per ton. Kamatrol is a good investment. It pays off quickly.

Mr. VOLKMER. I have some questions, Mr. Shelton, Donnie.

First, I would like to ask Dr. Kidd something. Chairman Fuqua of the full committee informs me that you have a nationwide reputation as a spokesman for the needs of small-sized farms. For the record, would you indicate the specific areas in small farms in which you are involved?

Dr. KIDD. We serve the northern and northwestern counties in the State of Florida. We are sort of centrally located in that area, Tallahassee being the capital and in the neck of the State, so we serve the counties that go westward, the counties that go to the east all the way over to Duval. So it is those northern and northwestern counties, about eight counties, that we principally serve from FAMU.

Mr. VOLKMER. And do you try to go across the spectrum in the farming community as to all the types of small farms?

Dr. KIDD. Yes. Of course, diversification is a characteristic of these small farms, both on an individual basis and when you look at them as a group. They are quite diversified because they are all struggling to try to figure out how to make a profit, and so they may even change from year to year in terms of what they do, which creates a tremendous problem for us in terms of delivering extension services. We have to keep up with them and try to stay ahead of them in terms of giving them some sort of useful information.

Mr. VOLKMER. Now, the utilization of extension services, is that basically for information dissemination?

Dr. KIDD. No, not just information. We, through our relationships with small farmers, carry on many demonstrations in the field and usually on the farmer's land. We do this individually as our university and, of course, in cooperation with IFUS at the University of Florida.

Mr. VOLKMER. Does extension do any evaluation of product lines that come out of the private sector?

Dr. KIDD. We are beginning to do this. This is the very reason that we feel that we have got to bring some of our work on behalf of the small farmers to the campus.

We have a 125-acre farm on our campus, and we are beginning to utilize that to evaluate, to test certain things that we think are going to work for the small farmers before we thrust it upon them and have them lose money trying it.

Mr. VOLKMER. All right. You mentioned the percentages of small farms of less than 50 acres, et cetera. How many of these, if you know, would you say rely on outside income in order to stay on the farm or have a farm?

Dr. KIDD. A very high percentage. I would say well over 70 percent of these people have other jobs, either on an ongoing basis or from time to time.

Mr. VOLKMER. In other words, part-time, whatever they can fit in, or seasonal-type work?

Dr. KIDD. Yes, exactly.

Mr. VOLKMER. And the income for most of these people is what, poverty line?

Dr. KIDD. Poverty line for a large number of them. Close to 50 percent of them earn less than \$3,000 annually from both sources of income.

Mr. VOLKMER. What is keeping them on the farm?

Dr. KIDD. Well, the lack of other opportunities in our particular neck of the woods. In Florida, there is not much industry in the north and northwest. That picture is beginning to change, and so there will be alternatives for them in terms of employment.

But, for the most part, when some of the farm products cease to be profitable, those people are without work, and they will find work by coming to Tallahassee or going to Orlando. In fact, some farming families have become migrant families because of the economic pressures.

Mr. VOLKMER. Now, of the technologies currently available, are there any geared toward the small-size farms, in other words, that are being developed?

Dr. KIDD. I think that you can look at the entire spectrum of technological innovations, and there are a number of them that are definitely going to be beneficial for small farmers. There is no barrier to their use by small farmers. The only barrier is that they cannot afford to either purchase the new variety of seed or buy the new tractor or make use of the new technology because they cannot purchase it, and that is really the barrier.

Many of these things are going to be very beneficial to small farmers. New varieties of seed, means of producing more milk or means of producing better meat from meat goats, et cetera, which are going to be a result of technological changes, will be beneficial to small farmers. But they are not in a position to take advantage of them economically.

Mr. VOLKMER. There are some areas of technology, in other words, such as embryo transfer for dairy cattle or something which, as it becomes more prevalent, your small dairyman probably is not going to be able to afford that for a while.

Dr. KIDD. That is right.

Mr. VOLKMER. So he is going to be left behind in that area.

Dr. KIDD. Right, just as small farmers today, many of them, don't take advantage of artificial insemination because it is a costly process.

Mr. VOLKMER. Mr. Shelton, you mentioned that some of the farmers are not able to utilize fungicides, et cetera, that you are able to apply to your seed. Most of your seed is all soybean, is that correct? I would like to clarify that for the record.

Mr. SHELTON. Yes, soybeans and wheat.

Mr. VOLKMER. Soybeans and wheat.

Mr. SHELTON. Soybeans and wheat in our area, yes.

Mr. VOLKMER. They are not able to do so, and therefore, that reduces their yields.

Mr. SHELTON. Yes. Well, whenever they come in, they realize that this will increase the yield, and when you tell them it is \$3.50 to put this on, it is a cost up front that—

Mr. VOLKMER. That is \$3.50 per bushel?

Mr. SHELTON. That is \$3.50 per bushel. This is a cost up front that they don't want to—their banker and so on says that they had

just better get by with getting their seed cleaned and go back to the field instead of applying this to their product.

Mr. VOLKMER. And the same thing, basically, applies to you with the computerized cleaning operation. If that cost one-third of the amount that is proposed to you, you could probably utilize that, could you not?

Mr. SHELTON. Yes, I could very much utilize it.

Mr. VOLKMER. Or if you had an operation that was four times as big?

Mr. SHELTON. That is true.

Mr. VOLKMER. But you then become a large seed operator and you no longer are medium size.

Mr. SHELTON. That is true. That is what is happening now, and it is a struggle to try to keep things in operation right now for me as well as the other farmers out there that I am dealing with right now.

Mr. VOLKMER. Do you find in this year—normally, by now farmers have made up their minds pretty well and have contacted you for purchasing their seed for this year's planting, have they not, I mean for beans? Wheat is already gone.

Mr. SHELTON. Right. The soybeans, it is real slow this time because we have gone strictly on a cash basis, and when you tell them that—when they pick it up, they pay for it, and I am not a banker; they are going to have to get their money from a bank; I just cannot afford to carry them—and so, therefore, they are slow about coming through and ordering stuff, and this is what I am finding with other exchanges, co-ops that I deal with. They tell me that with their chemicals and fertilizer and things such as that, they are just sitting back waiting, and whenever the day comes to go to the field, they are going to get—

Mr. VOLKMER. In other words, they are going to wait until the last minute before they do their purchasing?

Mr. SHELTON. That is true. That is what is happening. It kinds of puts us as suppliers in a bind to know where we are. We don't know just exactly how much to get ready for them or whatever.

Mr. VOLKMER. I have heard from people, of course, in your area and the west of there, around Moberly and that area, that there probably will be 5 to 10 percent of the land that may be even unplanted this spring because some of the farmers won't be able to get operating money. Would you agree with that?

Mr. SHELTON. Yes, I would, very much so.

Mr. VOLKMER. Most of those will be the medium-sized farmers, will they not?

Mr. SHELTON. That is what it will be. In our area, I would say the medium-sized farm. We are talking 400 to 1,000 acres is what we consider a medium-sized farm in our area.

Mr. VOLKMER. Right, and those are the ones that are hurting right now?

Mr. SHELTON. That is right.

Mr. VOLKMER. Most of the operations in your area are grain. There is some livestock, but most of it is grain, is it not?

Mr. SHELTON. Most of it is grain. There is some livestock there, but it is not like it used to be 20 years ago.

Mr. VOLKMER. Right. And we had about 4 out of 5 bad years as far as weather was concerned.

Mr. SHELTON. Yes, and this past year, the yields have been way down. It wasn't as bad as 1983. We had about a 10-bushel average in our area in 1983, and this past year we had—

Mr. VOLKMER. That is on beans?

Mr. SHELTON. This is on beans, yes, and about 15 to 18 maybe average on soybeans this past year. So that is what is really hurting.

Mr. VOLKMER. The normal yield would be?

Mr. SHELTON. The normal yield, our county average is like 31 bushels. So we are cut in half, and it is kind of hard to go to the banker and explain why you haven't got— well, he knows why we haven't got grain in our bins, but it is kind of hard for him to give us money when we haven't got anything there to back it up.

Mr. VOLKMER. Do you find other instances where farmers today are not able to utilize new technology?

Mr. SHELTON. Yes. There is a lot of technology out there. In the spraying equipment, there are spray monitors and things such as that. The technology is there for them, but they just cannot afford to buy it. This is one thing that they are not spending the money for. They are doing without it.

Mr. VOLKMER. And you mentioned the three implement dealers in the area. This is basically because most of the farmers, I guess, in the area are what you call medium-sized farmers and have not been able to purchase new implements for the last 3 or 4 years.

Mr. SHELTON. Yes, this is true. This is what has happened. I said three implement dealers closed. Two of them completely closed the doors, and the other one closed their doors, and they are kind of like an order house now. You can go in there and buy like you do at a catalog store. They will get you parts, and that is about the extent of it.

Mr. VOLKMER. I think you also mentioned to me earlier, before the hearing, that one of the larger implement dealers in the area, northeast Missouri, north central Missouri, had only sold one tractor in the last 4 months. Is that correct?

Mr. SHELTON. Yes, this is true. He is a very large dealer. He has got three big implement dealerships there in central Missouri, and I know it is hard for him to make ends meet, too, when he only sold one tractor in 4 months.

Mr. VOLKMER. At this time I will turn the questioning over to the gentleman from California.

Mr. PACKARD. Thank you, Mr. Chairman.

Mr. Shelton, I appreciate your testimony today.

Do you think there is a general reluctance or resistance to change by farmers?

Mr. SHELTON. I think the farmers will change, but it is economy right now that gives them a bad attitude about it.

Mr. PACKARD. I recognize the difficulty of implementing new technology because of cost. I remember two farmers that were neighbors to each other. One was considerably outproducing the other, and when the one farmer was asked why he didn't do some of the things that his neighbor did, he said, "I already know how to farm better than I do."

Many of us tend to know how to do things better, but we resist, not necessarily for cost but just a general reluctance to change. Farmers sometimes find themselves that way; in fact all people do.

Dr. KIDD, I was interested in just a passing comment you made in your testimony about black farmers in the South. In most areas that I am familiar with where farming takes place, there are very few black farmers across the country. I was wondering, just out of curiosity, if black farming is increasing or decreasing in America, in your judgment.

Dr. KIDD. It is decreasing drastically. I represent the first generation of my family to completely be divorced from farming activities out of Virginia. A few of my first cousins remain in Virginia farming, but they, too, have in recent years lost interest or lost the ability to do it. They more or less worked themselves to death going to Ford Motor Co. in Danville and then trying to handle 128 acres among the three of them.

So, yes, it has decreased drastically, and in Florida—

Mr. PACKARD. Would I be correct in assuming that most black farmers in America are small or moderate-sized farmers?

Dr. KIDD. Most of them.

Mr. PACKARD. Very few large?

Dr. KIDD. Very few large.

Mr. PACKARD. And I would assume, also, that most of them are concentrated perhaps in the South?

Dr. KIDD. In the South, yes.

Mr. PACKARD. That is interesting, and I wonder if there have been any studies done to analyze—and I am sure, if anyone has, it would be you and your institution, perhaps, that has analyzed—

Dr. KIDD. Well, we sit right in the middle of an area that is a case study in itself. Gadsden County, which is approximately 70 percent black, was mostly farming. When the tobacco growing ceased to be profitable, all those black farmers ceased to be involved in agriculture, primarily. Some of them still do some agriculture. They switched to beans, they switched to tomatoes, and of course they inherited all of the marketing problems associated with trying to eke out a living, while they hold other full-time jobs.

So we have a tremendous case study right in northern Florida of black farmers who have either left farming altogether or seriously reduced their involvement in farming.

Mr. PACKARD. Do you think that the trends in black farming are a microcosm of the trends in overall farming in the United States as it relates to small- and mid-sized farms?

Dr. KIDD. Oh, I think so, absolutely. The wave and the economic pressure hit that subgroup of farmers, I think, first. I can remember when, in my family, the same kinds of considerations about whether or not it was feasible to stay in farming—could you make a living?—hit the family, and we left farming, virtually.

Mr. PACKARD. My family seems to reflect a little of the same trend. It was a large family, and I think there was only one that remained in farming.

Do you believe that the trend in technology now, as it shifts from equipment to biotechnology and some of the more—well, the nonequipment or machinery type of technology—do you think that

trend will become more advantageous to the small- and mid-sized farms than the machinery technology in the past has?

Dr. KIDD. Oh, I think it definitely will. I think it is something that can be applied to small- and mid-sized farms, whereas some of the mechanization that we have seen developed in recent years is strictly for very large-scale farming and is not applicable.

But I think biotechnology and its innovations will be useful to small- and moderate-sized farmers, provided the cost is within range.

Mr. PACKARD. In the report—and I don't know whether you have had an opportunity to review the report that was done that has really precipitated this hearing—it mentions a good deal about—one chapter, as I recall, is on the land-grant college system in this country.

Do you think land-grant colleges, in the past, have been more favorable to small- and mid-sized farms or more favorable to the large farms?

Dr. KIDD. I think they have been, depending upon location, serviceable to large farms probably more so than they have to small- and moderate-sized farms.

In Florida, I think we have a unique situation where we have always had to attend to the problems associated with small farms, to a certain extent, but then again, if you look at the budgets and the activities for research and extension, it takes a tremendous amount of money to respond to some of the needs of large-scale farming operations such as citrus, beef cattle, et cetera, in the State of Florida.

And so it may dwarf, in terms of dollars, the expenditure for attention to small farm problems, but at least, in the State of Florida, small farms and their problems have always been uppermost in the minds of those planning for research and extension activities, especially the extension activities.⁵

I think our problem is that we have done it the same way for a long time, and now it is necessary that we become more efficient and effective and integrate the three elements of agricultural services to the advantage of small and other farmers.

I think perhaps if there is anything that can structurally change with respect to a farm bill, it would be how we budget and how we put expertise in the field, and how we fail to cross those lines between research and extension. They are beginning to be blurred, and I think they well should be, because we cannot keep pace with technological changes unless extension specialists are indeed well educated and educated in methodology for passing those nuances on to the farmer with little or no training.

Of course, we have also to bring our teaching back to the point where we bring in those young people from those farm areas so that they, too, will become more educated and at a level that they can use some of the technologies that are being developed. We just have to become more efficient and effective at doing what we are in business to do.

Mr. PACKARD. So, in your judgment, you feel that as we move from the machinery technology to the biotech areas, one of the best things the Government can do is to help direct extension and research in the direction of the small farm and midsized farm?

Dr. KIDD. Yes, I think so, and I think we have to look at different kinds of specialties, different kinds of training that we need for people to work in extension and to perform agricultural research.

We have traditionally looked at the agricultural disciplines, and now that, of course, has to be mixed with some new engineering areas, some biotechnology areas, and certainly information scientists.

Mr. PACKARD. What disadvantages do you think this country would inherit if the move continued toward larger and larger agribusiness types of farming that perhaps could produce agricultural products and make them available to the consumer at a cheaper price or better quality? How would you suggest we balance between the preservation effort of the midsized and small farm compared to the better productiveness and better quality of our produce to the consumer?

Dr. KIDD. I think quality is, of course, a very subjective thing which leads to the reason for preserving small and midsized farm operations. That speaks to a choice. It speaks to one element of freedom as far as the American way of life is concerned. One would like to be able to choose whether you want milk sent to you from Florida, if you live in Utah, or if you want some that was produced locally. Maybe you like butterfat; I don't know.

But I think it is a matter of having a balance, having a choice, having a way of life preserved that really sort of goes back to some of the foundations as far as the country is concerned. A lot of pride is associated with ownership. A lot of pride is associated with being able to make a choice. I think we would be in a sad state if we were not.

Mr. PACKARD. I totally agree with that. Thank you.

Mr. VOLKMER. Thank you.

Dr. Kidd, you mentioned about the use of extension in helping the small farms. What can be done to further bring extension on-line to be able to help the small and moderate farmer?

Dr. KIDD. In our situation—and I am sure it is mirrored in some other institutions—we would like to be able to open extension up, be able to reach into the university community a little deeper, and to utilize other scientists, other specialists, who may not in fact be in agriculture, but use them in terms of extension work, bring them in as consultants for specific problems.

I think rural sociology is a good example. We have had to augment our staffs either by having a research project which focuses on rural sociological problems and bring in those people to run those projects, but I think we need to do a little bit more than that. They perhaps should be a permanent aspect of our extension research administration.

Mr. VOLKMER. Is funding a problem?

Dr. KIDD. Funding is a problem. We are pretty tight. We have just about enough money to do what we have been doing. We do not have enough dollars in our budget to make any changes.

Of course, one wants to be fair. We have people who have been with us for some time. They are highly skilled, and they have been doing a very good job. But if I have to send one of them back to school to become more relevant, it is going to cost money.

Mr. VOLKMER. And that is going to be necessary if they are going to keep up.

Dr. KIDD. That is right.

Mr. VOLKMER. At least you are going to have to have some kinds of seminars or something to keep people up with changes in technology development.

Dr. KIDD. Right.

Mr. VOLKMER. A reduction in funding at this level for extension would really hurt you, then, wouldn't it?

Dr. KIDD. It would do serious damage.

Mr. VOLKMER. What if you were to receive a 10-percent reduction in funding for extension?

Dr. KIDD. I think we would have to cut out certain program areas that have become a part of extension over the past 5 or 10 years that are beginning to show some fruit. I think we would have to cut away some key people in our extension organization that serve part of the needs that small family farms or farm families have.

We have 4-H activities; we have home economics activities. I think we would be in serious trouble if we had to delete any portion of that. We need to be doing a better job. We need more people than we have, because we have a large area to cover, given our size.

Mr. VOLKMER. And without that assistance to these small farms, they would probably have further problems in deterioration, would they not?

Dr. KIDD. They would have further problems not only with respect to maintaining an interest and maintaining some level of activity in agriculture, but I think they would have a severe problem just plain surviving, coping, getting kids to go to school, and all of the other social ramifications of living in a primarily agricultural area which is functioning at a very low level.

Mr. VOLKMER. And if those people are not able to continue in farm operations, you mentioned that there is not that much industry, but they are going to have to go somewhere if they do not farm, if they cannot make it.

Dr. KIDD. They will go south in the State of Florida and do temporary work, or they will try to find jobs in nearby Georgia where there is industry. Some industries have recently opened up new plants in south Georgia, and that will take away some Floridians to work there.

But I think the decay as far as the community is concerned that they leave is obvious.

Mr. VOLKMER. That is what I mean. You have the same problem that I have in my district, then, the restructuring of that whole area, because that has implications on businesses; it has implications on the schools and everything else.

Dr. KIDD. It is an area that has been addressed at the Governor's level, and there is quite a bit of activity, I think, and, hopefully, it will bear some fruit and bring some other activities, business activities and manufacturing activities, to that area of the State.

Mr. VOLKMER. Dr. Kidd, the words have been conveyed to me by our chairman about your work, and I will have to agree; you have done an outstanding job, and I say keep up the good work.

Dr. KIDD. Thank you.

Mr. VOLKMER. Mr. Shelton, I would like to ask you—we have not discussed this, but in other words, when you obtain new information on new products such as the computerized cleaning system or fungicides to use on the seeds, et cetera, where do you obtain that information, usually, normally?

Mr. SHELTON. Well, it usually comes through the company representative, who comes out and talks to me, or I also get it through some of this extension work. In the wintertime, we go down to the university, and they have seminars, no-till seminars and things such as this, and they present this to us at that time.

Mr. VOLKMER. In other words, you do use extension pretty extensively from the University of Missouri?

Mr. SHELTON. Yes; I do. We are close enough to them there that they do benefit a lot of people there in that area right where I am because we are not but 25 miles from the university there.

Mr. VOLKMER. Do you obtain any of your information from private sources, companies that provide materials or anything?

Mr. SHELTON. I do get some from them, too. But they do a lot of experiments and things down at the university, and I work with them pretty closely on that, on the seed end of it, and I get a lot of information from them.

Mr. VOLKMER. From the university?

Mr. SHELTON. From the university, the extension people down there—

Mr. VOLKMER. It has been very helpful?

Mr. SHELTON [continuing]. Dr. Carl Morris and Dr. Harry Miner and those people such as that.

Mr. VOLKMER. Thank you very much.

Do you have any further questions?

Mr. PACKARD. No.

Mr. VOLKMER. Thank you very much, Dr. Kidd and Mr. Shelton. We appreciate your being here today.

Our final witness today is Dr. Orville Bentley, Assistant Secretary for Science and Education, Department of Agriculture.

Dr. Bentley, your prepared statement will be made a part of the record.

Oh, before I go to that, I forgot—but for the purpose of the record, I would like to have the statements in here without the commercial advertising, et cetera, in these booklets be made a part of the record following Mr. Shelton's statement, or where he alluded to them in the record.

Dr. Bentley, your statement, as I said before, will be made a part of the record. You may either review it or summarize it, however you so desire.

Please proceed.

STATEMENT OF DR. ORVILLE G. BENTLEY, ASSISTANT SECRETARY, SCIENCE AND EDUCATION, DEPARTMENT OF AGRICULTURE.

Dr. BENTLEY. Mr. Chairman and members of the committee, I am pleased to be here, and I note that you make reference to making my prepared statement a part of the record. I also submitted some

additional material. I hope that you will consider it as a part of the record as well.

I would like to take the opportunity to review some of the issues and make reference to them because I think they are very important as a part of this particular report from OTA.

I also want to note that many of the comments made and the questions asked to earlier witnesses really bear upon this issue. I note the reference to the work of the cooperation extension at the State level and the extension service of the State agricultural experiment stations and the agricultural research service in providing information that people used, and the reference made by several people to the relevance of this information to the needs of the farm community and of rural America.

I think that this report from OTA does bear on some important items, and we are in agreement in the USDA with many of the recommendations that appear in the report. I would note that I have not read the entire one, only the prepublication draft copy of parts of the report.

Specifically, I agree with the thrust of the report, which concludes that the American farmer must take advantage of new technological advances in agriculture or risk falling by the wayside.

I also agree without hesitation that the conclusion to apply brakes to the technological wheels of progress will have a devastating impact on the competitiveness of American farmers in world markets and, "instead of just some people being left behind, the whole American farm system would be left behind," is, Mr. Chairman, a very accurate statement.

Let's get to the heart of the entire matter. Small- and moderate-sized farms constitute the majority of America's 2.2 million farms. They are an important part of the agricultural structure, and there are indications that small farms are increasing in number. Such farms are operated by business people who grow crops, trees, livestock, or engage in other agricultural enterprises.

It should be noted that the 1.6 million small farms—those that sell less than \$50,000 per year in gross sales—are mainly part-time operations, while the much smaller number of the \$50,000 to \$500,000 gross sales farms are full-time, usually family operations. Most low-income problems are in smaller full-time operations.

Not unlike large farm operations, small and moderate farms must be both productive and produce high quality products to be successful. The acreage of these farms is considerably smaller than the average U.S. farm. However, the farmers operating these farms produce high quality products and meet the needs of the market through hard work and the use of new systems or new technology.

There are several good examples of ongoing efforts by the Department that focus on specific research that helps small- and moderate-sized farmers, and I want to summarize a few of those. There are more extensive references made in my full prepared statement.

Regardless of farm size, forage is a vital feedstuff for producers of livestock and dairy animals. In the northeast, small and moderate farms are predominant, and earlier studies reported cow/calf and sheep were the important livestock enterprises of small farms. An important source of protein and roughage for these animals is

alfalfa, and there has been reference made to alfalfa production earlier today.

In 1983, ARS began a study on the control of pest problems associated with legume crops. Beginning in 1894, extramural research funding by ARS was provided to four northeast State agricultural experiment stations, specifically focusing on the control of forage pests. This research would be targeted to small-scale farms.

The Colorado potato beetle is a major insect pest of potatoes, tomatoes, and eggplants. These vegetable crops have a value of approximately \$2 billion annually. It is a major pest of these crops due to severe pesticide resistance and ineffective natural enemies.

A wasp parasite of the Colorado potato beetle was introduced in 1980 from Colombia, South America, by ARS. A small farm research project was initiated in 1981 to determine the potential effectiveness of this parasite as a control measure for the pest. Tests through 1984 show that a total of 50 percent of all insect eggs are killed by the parasite.

Other examples of small farm research results are available for tree fruits, strawberries, thornless blackberries, and rural development. As I said earlier, I have attached to my written statement details on several of these projects which may be of interest to the committee.

Mr. Chairman, there is one underlying problem that must be addressed by everyone. While we talk about our programs and plans for the American farmer, we must not lose sight of the fact that these are trying economic times for the farmer.

A large number of the Nation's 2.2 million farms suffer from financial difficulties, with many of them facing serious survival problems. There has been reference to this earlier in the testimonies.

Nationally, the Cooperative Extension Service is directing approximately one-fifth of its total program resources in 1985 to respond to this situation. Resources devoted to these efforts have more than doubled in the past 2 years, with some States devoting as much as 45 percent of their resources to these programs.

Up to 35 percent of Extension resources in some States have been redirected from other programs to this top priority effort, with substantial further redirections slated for 1985.

I make reference to this because there were comments in the presentations made earlier and in the OTA draft report that I read to the fact that Extension needs to redirect efforts and look to some of the current problems, and I think this is ample evidence, and I want to go on to speak about some specific illustrations.

Iowa is one of the corn belt States hardest hit by the current problem. Almost one-third of the State's 115,000 farms are in severe financial difficulty. These 35,000 farm families carry 60 percent of the total Iowa debt load. Since January of 1984, 2,600 of them have received intensive assistance from the Extension staff, and an additional 14,000, from personnel directly trained by Extension. Iowa's Extension outreach has touched more than 95 percent of the State's farm families with financial management information in the last 13 months.

Nebraska cooperative extension has provided direct financial management assistance to nearly 6,000 farm families since Janu-

ary of 1984. About 900 of these families received intensive financial management assistance, including development of a revised farm business and financial plan. Since the Extension hot line began in September of 1984, more than 875 families have been assisted. Two-hundred-seventy-three of them sought help in January 1985 alone.

Similar efforts are occurring in your State, Mr. Chairman, Missouri, Nebraska, Michigan, and other States. To expand State programs, the extension service of the Department has funded 18 intensive efforts involving 22 State Extension Services, with \$1 million from the fiscal year 1985 appropriation.

The key objective of this intensive effort over the next 3 to 9 months is to implement changes for improving their present financial situation. Key factors in selecting these projects from 46 submitted were the magnitude of the financial crisis and the number of farmers targeted to quickly receive intensive help.

We have a report that has been provided to the committee that deals with this subject. This one is the "Cooperative Extension and Agricultural Profitability: Fighting Farm Financial Crisis on the Front Line," which is referred to, and "Regaining Farm Profitability in America."

Having had some part in this activity, I can say to the committee that the effort made by the extension service under the leadership of Dr. Greenwood and the State directors of the cooperative extension service reflects a very strong effort on their part to work together to come up with this program, and I am pleased to report on it to you today.

Now I want to go to biotechnology. Mr. Chairman, in reviewing the draft of the OTA report, I take note of the many references to biotechnology. Biotechnology and genetic engineering do hold great hope for the small- and moderate-sized farmers.

But while we have in the past spoken in more futuristic terms about biotechnology, I am pleased to tell you this morning that less than 24 hours ago, Secretary John Block announced that tests by scientists of the Agricultural Research Service and the private sector have given us encouraging results of a genetically engineered antigen that could become a key to developing a vaccine against coccidiosis, a disease which costs the American poultry industry an estimated \$300 million a year.

The antibodies that were produced came as the result of the use of hybridoma biotechnology, and they represent, we hope, what will be the first of many successful applications of this new technology to solve long-standing problems for the farmer. I want to stress this matter, the long-standing problems, because we think with the new science and technology that we will be able to address some old questions and deal with them, some that have been persistent for a long time.

Development and selection of improved species, varieties, and races of plants and animals are the cornerstone of our tremendously productive U.S. agriculture. In the early 1970's, there emerged a concern that our store of fundamental knowledge in the agricultural sciences was running low, and that if we were to solve some of the really difficult problems that continued to limit our ability to improve the productivity and profitability of agriculture, we

needed to replenish this store of fundamental knowledge through an increased effort in basic research.

The results of this effort to date, including the relatively short time that we have had the USDA Competitive Research Grants Program in place, and those expected in the future, should benefit all phases and segments of agriculture and all consumers.

The research being conducted is not farm-size oriented or goal driven. For example, with the new technology of genetic engineering, the range of genetic variability available to the plant breeder is vastly extended. No longer will a breeding program be limited to those characteristics that already exist within a species or its very near relatives. It will become possible to engineer, in one step, a specific genetic change that would require several generations in a breeding program. Plant scientists can now grow and evaluate 100 million cells, each a potential plant, in a single small flask.

I want to turn to another subject, and that is technology transfer. We think this is an appropriate one to address at a hearing in which we discuss the impact of change on the American farmer.

The value and importance of patents as a tool to bring about expeditious development of Government-funded technology was recognized by the enactment of Public Law 96-517. This law authorized Federal agencies to award exclusive licenses on Government-owned patent technology and gave first option to ownership of inventions to small businesses and universities under federally funded agreements.

Prior to passage of Public Law 96-517, the USDA retained ownership of inventions made by universities and small businesses, except for those agreements with land-grant institutions. Land-grant institutions receiving funds under the Hatch Act agreements always have been entitled to patent ownership.

Since universities and small businesses have been allowed to retain ownership of inventions under funding agreements, there has been a ten-fold increase in the number of inventions reported to USDA.

Through the exclusive licensing efforts of the USDA, companies have pledged to commit a sizable amount of capital to develop and market patented USDA technology, a substantial departure from past experience.

Patented technology made freely available to all under past non-exclusive licensing policy was used by few because the industry was reluctant to invest in heavy manufacturing costs without protection of exclusivity. Exclusive licensing has stimulated industry to develop Federal and State patented research so that the benefits of it become available to the public. We must always remember that 90 percent of the cost of R&D is associated with the D part of this endeavor.

There is yet another area which is tied to the whole picture of agriculture, that of providing agriculture with a trained cadre of scientists, technicians, and other professional workers.

The USDA Office of Higher Education is concerned with this situation and is devoting a great deal of effort toward finding solutions to the problem. It was announced this past Friday that public and private institutions have launched a 5-year project to reverse a decline in interest in agricultural sciences in college curricula.

The project involves the USDA and the colleges and universities, with financial support from private foundations and businesses. Project teams from supporting organizations will work on steps to help the 142 land-grant and other colleges and universities that offer degrees in food, agriculture, and natural resources.

Areas targeted for improvements in college curricula are computer literacy, ethics and public policy, cultural and social aspects of domestic and international agricultural systems, internships, systems of integrated pest management for crop production, cooperative education, and student projects.

Mr. Chairman, as I have said earlier, there are a number of documents that we would like to submit for the record that would address some of the issues raised in the OTA report, and if the committee would like to have greater detail on our USDA activities in the areas of farm profitability, technology transfer, research results applicable to small- and moderate-sized farms, and the activities of the extension service, we would be glad to provide it.

I appreciate the opportunity to appear this morning.

[The prepared statement of Dr. Bentley follows:]

Testimony of
Dr. Orville G. Bentley
Assistant Secretary
Science and Education
U.S. Department of Agriculture
Before the
Investigations and Oversight Subcommittee
of the
Committee on Science and Technology
U.S. House of Representatives
Washington, D.C.
March 19, 1985

FOR RELEASE ONLY BY THE
HOUSE COMMITTEE ON
SCIENCE AND TECHNOLOGY

Mr. Chairman, I appreciate your invitation to meet with you and the Members of this important Subcommittee today to talk about the impact of technology on America's farmers, particularly those operating small-to-moderate size farms.

Although I have not had the opportunity to review a final copy of the report on this subject which is being issued today by the Office of Technology Assessment, your staff supplied me with a pre-publication draft copy. Based upon that draft, it does appear that there are many areas of agreement between USDA and those who compiled this report.

'Specifically, I agree with the thrust of the report which concludes that American farmers must take advantage of the new technological advances in agriculture or risk falling by the wayside.

And, I agree without hesitation with the conclusion that to apply brakes to the technological wheels of progress would have a devastating impact on the competitiveness of American farmers in world markets and "instead of just some people being left behind, the whole American farm system would be left behind".
Mr. Chairman, that is a very accurate statement.

Let's get to the heart of this entire matter: Small and moderate size farms constitute the majority of America's 2.2 million farms. They are an important part of the agriculture structure and there are indications that small farms are increasing in number. Such farms are operated by business people who grow crops, trees, livestock or engage in other agricultural enterprises.

It should be noted that the 1.6 million small farms -- those that sell less than \$50,000 per year in gross sales -- are mainly part-time operations, while the much-smaller number of \$50,000-\$500,000 gross sales farms are full-time, usually family operations. Most low-income problems are in smaller full-time operations.

Not unlike most large farm operations, small and moderate farms must be both productive and produce high quality products to be successful. The acreage of these farms is considerably smaller than the average U.S. farm. However, the farmers operating these farms produce high quality products and meet the needs of the market through hard work and the use of new systems and/or technology.

There are several good examples of ongoing efforts by the Department that focus on specific research that helps small and moderate size farmers. Below, I have listed a few examples pertaining to forage/livestock and horticulture, and I want to review these examples for this committee:

Regardless of the farm size, forage is a vital feedstuff for producers of livestock and dairy animals. In the Northeast, small and moderate farms are predominant and earlier studies reported cow/calf and sheep were the important livestock enterprises of small farms. An important source of protein and roughage for these animals is alfalfa.

In 1983, ARS began a study on the eradication and/or control of pest problems associated with legume crops. Beginning in FY 1984, extramural research funding by ARS was provided to four Northeast State Agricultural Experiment Stations specifically focusing on the control of forage pests and this research was targeted to small-scale farms.

The Colorado potato beetle is a major insect pest of potatoes, tomatoes, and egg plants. These vegetable crops have a value of approximately \$2 billion annually. It is a major pest of these crops due to severe pesticide resistance and ineffective natural enemies.

A wasp parasite of the Colorado potato beetle was introduced in 1980 from Columbia, South America, by ARS. A small farm research project was initiated in 1981 to determine the potential effectiveness of this parasite as a control measure for the pest. Tests through 1984 show that a total of 50 percent of all insect eggs are killed by the parasite. This demonstrated the potential effectiveness of the parasite.

Other examples of small farm research results are available for tree fruits, strawberries, thornless blackberries and rural development. I have attached to my written statement details on several other projects which may be of interest to this Committee.

Current Financial Difficulties of Farmers

Mr. Chairman, there is one underlying problem that needs to be addressed. While we talk of our programs and plans for the American farmer, we must not lose sight of the fact that these are trying economic times for the farmer.

A large number of the Nation's 2.2 million farms suffer from financial difficulties with many of them facing serious survival problems.

Nationally the Cooperative Extension system is directing approximately one-fifth of its total program resources in 1985 to respond to this situation. Resources devoted to these efforts have more than doubled in the past two years with some states devoting as much as 45 percent of their resources to these programs. Up to 35 percent of Extension resources in some states have been redirected from other programs to this top priority effort with substantial further redirections slated for 1985.

Planning, programs, and staff resources are targeted to farmers, their families, rural communities, agribusiness, and related lending institutions and social services. Cooperative Extension is working to implement a multi-disciplinary, integrated systems approach to improve the profitability of agriculture over the long term while dealing directly with the short-term crisis of today's financially distressed farmers.

Iowa is one of the Corn Belt states hardest hit by the current problem. Almost one-third of the state's 115,000 farms are in severe financial difficulty. These 35,000 farm families carry 60 percent of the total Iowa debt load. Since January 1984 2,600 of them have received intensive assistance from Extension staff and an additional 14,000 from personnel directly trained by Extension. Iowa Extension's outreach has touched more than 95 percent of the state's farm families with financial management information in the last 13 months.

Nebraska Cooperative Extension has provided direct financial management assistance to nearly 6,000 farm families since January 1984. About 900 of these families received intensive financial management assistance, including development of a revised farm business and financial plan. Since the Extension hot line began in September 1984, more than 875 families have been assisted--273 of these sought help in January 1985 alone.

Similar efforts are occurring in Missouri, Nebraska, Michigan and several other states. To expand state programs, Extension Service, USDA, has funded 18 intensive efforts involving 22 State Extension Services, with \$1 million from FY 1985 appropriations. The key objective of this intensive effort over the next three to nine months is to implement changes for improving their present financial situation. Key factors in selecting these projects from 46 submitted were the magnitude of the financial crisis and the number of farmers targeted to quickly receive intensive help.

More details on these ongoing efforts appear in a recent report put out by Cooperative Extension that will be provided to this committee.

Potential of Biotechnology

Mr. Chairman, in reviewing the draft of the OTA report, I take note of the many references to biotechnology. Biotechnology and genetic engineering do hold great hope for the small and moderate size farmers. But, while we have in the past spoken in more futuristic terms about biotechnology, I am pleased to tell you this morning that less than 24 hours ago Secretary John Block announced that

tests by scientists of the Agricultural Research Service and the private sector have given us encouraging results of a genetically-engineered antigen that could become a key to developing a vaccine against coccidiosis, a disease which costs the American poultry industry \$300 million a year.

The antibodies that were produced came as the result of the use of hybridoma biotechnology -- and represent what we hope to be the first of many successful applications of this new technology to solve long-standing problems for farmers.

Development and selection of improved species, varieties, and races of plants and animals are the cornerstone of our tremendously productive U.S. agriculture. In the early 1970's there emerged a concern that our store of fundamental knowledge in the agricultural sciences was running low, and that if we were to solve some of the really difficult problems that continued to limit our ability to improve the productivity and profitability of agriculture, we needed to replenish this store of fundamental knowledge through an increased effort in basic research. The results of this effort to date, including the relatively short time of USDA/CRG program, and those expected in the future should benefit all phases and segments of agriculture and consumers. The research being conducted is not farm size oriented or goal driven. For example, with the new technology of genetic engineering, the range of genetic variability available to the plant breeder is vastly extended. No longer will a breeding program be limited to those characteristics that already exist within a species or its very near relatives. It will become possible to engineer, in one step, a

specific genetic change that would require several generations in a breeding program. Plant scientists can now grow and evaluate 100 million cells, each a potential plant in a single small flask.

Plant breeders will do even more to develop plant characteristics to better adapt to specific conditions of soils and climate. In this sense, great strides have already been made in the biotechnology research area. A set of experiments in progress concentrates on the ice-nucleating gene.

Much frost damage to plants is caused by "ice-nucleation active" bacteria. The microscopic bacteria promote the formation of ice crystals. Plants covered with these bacteria freeze and are damaged or killed at temperatures as much as nine degrees Fahrenheit higher than plants without them.

A chemical product of one strain of bacteria acts as a starter crystal around which frost can form. Through experimentation, the genes that cause the bacteria to have the ice-nucleating ability were isolated. Using recombinant DNA techniques, the sequence of genes causing the problem was excised, leaving the bacteria intact and otherwise identical.

The engineered bacteria, when applied to crops, will replace the ice-nucleating bacteria, lower the plants' freezing points and thus prevent frost damage. This process could save U.S. farmers up to \$1 billion a year in losses due to frost damage.

It will be particularly helpful on fruits and vegetables. Had this bacteria been available for use in the field over the last two years, it could have reduced significantly the enormous losses suffered by the citrus industry.

Extension's Integrated Pest Management (IPM) programs serve as examples of how various technologies can be transferred to farms of all sizes. One of the technologies is computer modelling of pest population growth or plant disease development.

The models are driven by meteorological factors such as temperature and moisture. Commercially produced units which integrate meteorological data collection, data input and processing, and information output are currently being used in orchards and fields, and Extension is helping their owners to interpret and utilize the information they provide.

These units are generally beyond the means of moderate or small farm operations, but Extension helps operators of those enterprises use the same models. Weather data are collected by volunteer observers or established sources such as National Weather Service stations and entered onto a computer at the Extension office.

These data drive the model, and output is transferred onto a telephone answering machine. Any interested individual may call for the information and receive a recorded vocal description of the situation as well as recommendations for dealing with it.

Pest identification and monitoring is an important part of IPM programs, and Extension educational programs teach techniques for accomplishing these functions. Use of insect pheromones, sequential sampling methodologies, and disease diagnoses are included in the technology. Large farms may have a staff person assigned to these tasks.

Smaller farms may hire private consultants to do the same thing. Other options are cooperative hiring of individuals to perform pest scouting for members of the cooperative group, or performance of pest scouting by the farmer or members of the family. Extension training programs in application of the technologies are designed so that members of any of these groups can participate and learn the techniques.

The Extension Service and the Agricultural Research Service are cooperating in a project which has the potential to put research results into the hands of State Extension workers as much as a year earlier than traditional methods. Prior to publication in scientific journals, summaries of research results are entered into a database on the computer system utilized by Extension for its own electronic mail and Accountability/Evaluation system.

This provides a means by which ES/USDA National Program Leaders may use electronic technology to speed ARS research results to targeted State Cooperative Extension counterparts. The state specialists can then select the reports that may be applicable to their state, and begin the adaptive process necessary to transfer technology into the hands of farmers. Implementation of the system on a National basis may be possible before the end of this year. Currently, a pilot test is under way with six states.

The system is known as Research Results Database (RRDB). It will do more than speed research results from experimental into operational technology. It will provide a more systematic feedback mechanism for identification of additional research needs. This will help define the gaps that may begin to appear between research and Extension functions as new technology increases, and allow us to bridge those gaps before they become serious.

Transfer of Patented Technology

Mr. Chairman, there is another issue which I believe is most appropriate to address in this hearing as it does have an impact upon the American farmer. The value and importance of patents as a tool to bring about expeditious development of Government-funded technology was recognized by the enactment in 1980 of Public Law 96-517. PL-96-517 authorized Federal agencies to award exclusive licenses on government-owned patent technology and gave first option to ownership of inventions to small business and universities under Federally-funded agreements. Prior to passage of PL 96-517, the USDA retained ownership of inventions made by universities and small businesses, except for those agreements with land grant institutions. Land grant institutions receiving funds under Hatch Act agreements always have been entitled to patent ownership. Since universities and small businesses have been allowed to retain ownership of inventions under funding agreements, there has been a ten-fold increase in the number of inventions reported to USDA.

Through the exclusive licensing efforts of the USDA companies have pledged to commit sizeable amounts of capital to develop and market patented USDA technology a substantial departure from past practices. Patented technology made freely available to all under past nonexclusive licensing policy was used by few because industry was reluctant to invest in heavy manufacturing costs without protection of exclusivity. Exclusive licensing has stimulated industry to develop Federal and State patented research so that its benefits become available to the public. Remember that 90.0 percent of the cost for R&D occurs in the D part.

Many more examples of technology advancements could be cited, such as major beneficial changes for plant and animal producers through new research approaches, biocontrol techniques for pest control, and sculpturing of seedbed design to maximize energy absorption to benefit early plant growth and to reduce soil loss from erosion.

I would note that there are concerns -- concerns shared by those of us in USDA and the scientific community -- for the regulatory aspects of biotechnology. The National Academy of Sciences has expressed interest in the potential effects of releasing genetically engineered microorganisms into the environment. Such a study could provide a foundation for making regulatory judgments. In addition, the White House Office of Science and Technology Policy is coordinating an effort to examine the regulatory jurisdictions over products resulting from biotechnology. A working group has been formed (under the aegis of the Cabinet Council on Natural Resources and the Environment) to study the current regulatory responsibilities of Federal agencies. USDA is an integral part of this activity.

There is yet another area which is tied to the whole picture of agriculture -- that of providing agriculture with a trained cadre of scientists, technicians, and other professional workers. The USDA Office of Higher Education is concerned with this situation and is devoting a great deal of effort toward finding solutions to the problem. And, it was announced this past Friday that public and private institutions have launched a five-year project to reverse a decline in interest in agricultural science in college curricula.

The project involves USDA, and colleges and universities with financial support from private foundations and businesses. Project teams from the supporting organizations will work on steps to help 142 land grant and private colleges and universities that offer degrees in food, agriculture and natural resources.

Areas targeted for improvements in college curricula are computer literacy, ethics and public policy, cultural and social aspects of domestic and international agricultural systems, internships, systems of integrated pest management for crop production, cooperative education and student projects.

Mr. Chairman, I have attached to my written testimony a number of documents which will provide you and the other Members of this Committee with greater detail on USDA's activities in the area of farm profitability, technology transfer programs, research results applicable to small and moderate size farms, and on the activities of the Extension Service.

Again, I thank you for the opportunity to appear and I welcome your questions.

Mr. VOLKMER. Thank you very much, Dr. Bentley. I appreciate your comments on the general overview of the operation of the Department and extension and also the Agricultural Research Service and cooperative extension and also on the OTA report.

Now, are we going to see any change in our direction from USDA to your State cooperative extension services in regard to technology transfer?

Dr. BENTLEY. One of the documents that I submitted shows that we are active, have been actively engaged now for at least almost 2 years in a joint effort involving the Agricultural Research Service laboratories and the extension service to help move technology more rapidly from the laboratories, the Federal laboratories, into use.

Under this system, we have been putting on a computer information about new developments in technology in the ARS and then making that information available in the various kinds of communication systems, DIALCOM, et cetera, so that the industry can dial in, go in and ask a specific individual about research activities. This is an effort here.

We think that in the land-grant college system, as in the University of Missouri, where you have the extension service and the experiment station working together, that they have done a pretty good job of communicating and working together in distributive information.

I think there are a couple of things that are changing, that have changed in many States already, where we see the State extension specialists in given crops or livestock, et cetera, but particularly it appears in the crops, plant pathology, entomology, and so on, horticulture, where the extension specialist also participates in the demonstration type of activities within the State.

Using Illinois as an example, I think we had 17 locations around the State where various kinds of tests were conducted, and many of those were directed and led by members of the extension staff that had, in addition to their regular extension appointments, responsibility in the agricultural experiment station to conduct some of the testing and so forth. I think we will see more of those activities.

Finally, I just would point out that, in defense of my colleagues in extension, and having been around a while and watched a number of things come into being, I have heard the same question raised, that extension has the capacity to change and to adopt new ideas and meet new challenges if we give them resources and the time and do the joint planning effort.

After all, with the introduction of about three major things about 20 to 25 years ago, at that time the whole matter of hybrid seed was coming into being. That was a whole change that took a lot of time. People realized they had to use more fertilizer, more water, more intensive planting systems, and all of that.

I recall people saying that no one can cope with this change. It came about very rapidly, and we were changing. The incidence of hybridization in swine production was a much contested, hot topic that went through our part of the country—and I am from the Midwest—and they were hollering change, and you hear nothing about that subject any more.

The commercial feed industry changed the way American agriculture operated, and extension became a part of that. Now, those are some years back; yet going into the rapid expansion, the changes in agriculture that took place in the 1970's, there was a great deal more interest on the part of farm operators to talk about financial management, marketing, and so forth.

To use a specific illustration, I recall well the times when there were meetings, again in Illinois because that is where I was at the time, that we had, say, in the early 1970's. If you would have a general extension meeting, say, that dealt with a major commodity—corn in the case of Illinois, or soybeans—and you had a number of seminars going on and maybe 1,000 people in attendance, most of the people went to the production-oriented activities—disease control and so forth—and the section that had to do with the farm business and the use of the futures market in selling and so forth would have a small audience.

Five years later, if you had the same meeting—and they did have every year, and drew large numbers in many locations throughout the State—probably one-third to one-half of all the people wanted to go to the meetings that dealt with marketing, and less went to the production. That kind of thing took place in the 1970's, and I think that we have the capacity to do it now.

In the biotechnology field, sure, there will be differences. But much of biotechnology, we hope, will get transmitted to the farmer for use through improved seeds just like it has before. If they put disease resistance or insect tolerance into a seed, the rice kernel or the wheat kernel or whatever will be the same general shape. It will be planted and we will get this technology. There may be some increased costs to doing this, we think, I think.

Now, the example has been used of embryo transplant. Yes, that is different. That will require some sophisticated technology, but there are already emerging in the United States a number of area-based and local groups that are using this kind of technology or making this kind of technology available.

Again, there is a matter of cost. I cannot pass judgment on that, but I think that we can meet this challenge, and I believe that if we work together—and we are working talking about this, and within the extension, we are trying to find answers.

Mr. VOLKMER. What do we do about the problem where the Agricultural Research Service and Government research develop much of the improvements in production, whether it is in livestock or crops, but we also have development by the private sector?

Dr. BENTLEY. Yes.

Mr. VOLKMER. Now, how do we determine the efficacy and the evaluation of things by the private sector on products for the farmer so that he can—are we going to have Extension do any of that?

Dr. BENTLEY. I think it will perhaps be more sophisticated, but I would predict that it will continue to be somewhat in the same mode as we are doing things today; that is, one place is the marketplace, that if one sells a product that is not successful, the farmer is not likely to come back and buy that same product again. That is one important factor.

I think that we will have to continue, even though people sometimes say that we should not be doing this in the public sector. There is a great deal of extension education that is carried on through demonstrations. It is still one of the best ways for livestock or forest practices or whatever, vegetables, fruits, et cetera.

One of the best ways of drawing people to hear about new information is a field day, a demonstration where you actually have tests operating. I am sure that many, many of them are carried on in both of the States that are represented here in your committee that evaluate chemicals for weed control, insect control, disease control, et cetera, management practices, and cultural practices. I think those will continue to be a place.

There has been and continues to be in many States systems of looking at corn. In the 1940's—well, early on in the introduction of hybrid seed corn, there was a great concern about the fact that since the commercial seed corn companies has closed pedigrees, that a farmer wouldn't know whether or not that product was going to be a good one.

There developed—it has been a long tradition in many States for seed corn comparison test trials, and a lot of those are continuing. Sometimes those are much criticized as being unnecessary, but I think they have continued on a fee basis in many States, and I think they will continue to meet some needs.

I would hope that we can avoid, though, the feeling that the private sector will not produce a product that is going to be profitable and that it will be beneficial to the farmer and to our food and fiber industries and to our consumer. We are producing products for our consumers here, and we would hope that these would improve. Perhaps there will be opportunities for collaboration and cooperation. There is a lot of that today, and I think we might see more of this kind of thing rather than less.

So there will be a combination of these kinds of things that I think, I hope, will serve the farmer.

Mr. VOLKMER. Thank you. I yield to the gentleman from California.

Mr. PACKARD. Thank you, Mr. Chairman.

Dr. Bentley, do you think that the greatest threat to the small- and mid-sized farmer in America is from within the farming industry, or do you feel that it is from foreign competition?

Dr. BENTLEY. I would couch my answer by saying that I think all of American agriculture, in fact all of American industry, in my opinion, must think about its competitive position in world markets, and that the efficiency of production, the quality of the product they put on gets to be important.

Now we turn directly to agriculture. Insofar as the cost of production and the efficiency of production, it may be a little higher in some of the smaller or medium-sized farms, but I am not willing to grant even that, in every dimension, foreign competition could be difficult.

I guess I see that smaller and medium, especially the smaller farm, finding an important niche in providing a kind of service and a unique service, and I think that it is likely to continue to be successful. Therefore, I think that all of agriculture has the problem of competition, and it would not necessarily mean that the small- or

medium-sized farm would be any more disadvantaged than another. We have to be competitive in all areas.

Mr. PACKARD. Is farming in foreign countries small and moderate sized, or do we see a lot of agribusiness in foreign markets?

Dr. BENTLEY. You are talking about production of major crops?

Mr. PACKARD. Production?

Dr. BENTLEY. Well, of course, there has been a big change in 25 or 30 years since the immediate post-World War II era. It is very clear that there is production capacity in countries that did not have production capacity in the 1950's. That varies, and as I look at the European situation, I have not traveled extensively in Europe, but I have seen enough of the areas to see two kinds of developments.

One is, in France there is some large-scale agriculture. I understand in the last few years that one of the second or third best markets for large tractors has been France, for the United States, and they have changed their wheat production. They have increased wheat production substantially in France in the past few years.

Mr. PACKARD. Do you think it is a true statement that the competitive edge or the competitiveness that the United States farmer has been able to experience—and it has not been a competitive edge, necessarily—has been because of high technology in equipment and machinery as well as biotech activities, where we might have implemented those technological advances more readily than foreign markets or foreign producers?

Dr. BENTLEY. My bias is an emphatic yes to the answer to that, that it has made a difference. I guess I am one that believes it will make a difference, that it will be a big difference in the future.

Mr. PACKARD. Do you think that foreign producers are going to be more readily implementing those advances than perhaps we will be in the future? I guess the question is, do you think there is a chance that we might lose that competitive edge through the technology where foreign producers may now begin to implement better equipment as well as better biotech?

Dr. BENTLEY. I feel very strongly that, given the entrepreneurial capacity of our American farm system and the favorable situation we have weather-wise and our institutions—all of our institutions, public and private, that serve agriculture—I think that there is no doubt about it, that the American farmers can maintain leadership in this area.

That does not mean that other countries are not going to adopt technology. I have been in Holland and driven around a good bit. Those are very small farms, very specialized farms. They have small equipment. They have mechanized unbelievably in the last 25 years, and I think they are going to continue to do that.

So it becomes a matter of competition and so forth, and I think with the leadership we have in agriculture and our governmental structure, our private sector, if we work together, we should maintain a strong competitive position, but we cannot do it just on a laissez faire attitude. We have to be aggressive in developing science and technology and applying it, finding all kinds of institutional arrangements to be sure that we utilize the great expertise and capacity of our public and private sectors.

Mr. PACKARD. From your testimony, Dr. Bentley, I take it that you strongly feel that the small- and moderate-sized farm in America will survive.

Dr. BENTLEY. You know, what you are getting at is problematical. My feeling is that the smaller farmers, because of many of the reasons that have already been brought out today, will find a place and will have a niche and a place. The same way with the medium-sized farms.

There will be some changes, I am sure. There is no doubt about it; there will have to be some changes made. But many will survive, and there will probably be the emergence of some larger farms. I don't think there is much doubt about that, because as a good operator, a good entrepreneur learns, if he believes in his tendency to tie with the American idea, he is going to try to, he or she is going to try to expand their operation, use their talents more fully, and will be a larger operator.

Mr. PACKARD. What do you think the Federal Government can best do to help that survival and actually enhance the small- and medium-sized farm?

Dr. BENTLEY. I would endorse very strongly comments that have been made by other witnesses that one of the very important roles of government, it seems to me, is the generation of information and knowledge and getting it out, especially to an industry that has one unique characteristic.

There are many operators. There is no a single focus. If one starts speaking about a corporate structure such as a General Motors, there is one central planning group that can say something about all of the plants and so on, look at their cash flow, look at their inventories, and make decisions.

It is very difficult for the farmers to do that and to get information. I would think that one of the things that the Department of Agriculture was created for in the first place was to gather information and disseminate it to farmers around this country, and that still remains an important thing.

I guess, in the development of science and technology, not to be the only ones, but we ought to be supporting research, and I am so recommending to the Secretary. The Secretary of Agriculture, within the constraints of our budget, is recommending that we do this.

There is a role for extension education because of the uniqueness we spoke of, and I think this will be more important in the future instead of less. Perhaps you would expect my bias to be in that direction, but I feel pretty strongly, and it is a pretty strong motivation for what I am trying to do.

Mr. PACKARD. I am pleased to hear you indicate that you feel one of the strong things that we can do from the Federal level is to disseminate information. I totally agree with that. Obviously, if a farmer had a crystal ball that could tell him what to plant and how much and when, there would be no financial difficulty for them. Their concern, of course, is being able to compete in the marketplace.

Dr. BENTLEY. That is right.

Mr. PACKARD. That often is a matter of supply and demand, as most of the private sector is. I personally think that farming epitomizes the entrepreneurial——

Dr. BENTLEY. Taking risks.

Mr. PACKARD [continuing]. And the risk-taking attitude that America has been strengthened by. And, frankly, we do have a lot better crystal ball than what we have been giving to the American farmer. We do have a lot of information in terms of pricing, in terms of supply, and in terms of demand and shortages and surpluses, and we have a lot of information that perhaps, as a Government, we have not done a good job of providing that information in a timely manner to the farmer that might help him in the decision-making as far as planting is concerned and his whole management of his agricultural business.

One area we have not discussed at all today that I would like to just open up briefly with you and get your comments on, and that is potential implication that any new taxing mode might have upon farming, both small-, medium-sized, and large farming.

Obviously, there is going to be, and there are now, discussions and debate on different taxing modes—flat taxes and removing a lot of the incentives for sheltering and so on. It involves property ownership and it involves farming, equipment and a multitude of other things.

Do you have any feelings about the direction that our tax debate might take as it relates to farming and particularly as it relates to small- and medium-sized farming or agribusiness itself? Do you have any comments on that whole area?

Dr. BENTLEY. Given the complexity of that, prudence tells me that I should beg lack of knowledge on it, but I will share my personal views, and I think that is what you asked for.

We may see some trends that will have tax implications about ownership of land. One of the prime concerns of farmers—and I come from western South Dakota, so I know something about it in my family background—is the desire to own land; that is, to own the production enterprise.

Many people feel that we may be coming to a time when there will be less emphasis on the land ownership by the operators themselves, and that there might be people that, say, would have machinery, entrepreneurial knowledge, and so forth, and that they would operate a plant somewhat as in a business mode.

We hear people talking about that as a way to share the risks that the farmers are taking. Certainly many farmers that are in trouble financially today can trace some of their difficulties back to overinvestment in land prices and a decision that—and I guess we ought to keep in mind that not only farmers make decisions like that, but other parts of our economy did. For example, the oil industry, I think, made some assumptions about oil prices that probably led to serious difficulties in investment rates and so on, much as the farmers did.

Many farmers are concerned about what they deem to be unfair competition from outside forces that use land, say, as a tax shelter, and so forth, and therefore have less incentive whether they make money or not in a given year, that they can take 10 or 15 years and

will come out all right, whereas the farmer has to do something about this year and next year.

So I think it does have some implications for it. Just exactly how much—I guess what the taxes and what I know about taxes in this is that it might not have as much direct effect on the small farm and the medium-sized farm as some of the larger farms where the tax incentive may be more of a factor in making that unit profitable for the investor.

Mr. PACKARD. I have an example of the effects of tax incentives on farming, and particularly on the small- and medium-sized farmers in my area. We have a unique kind of farming on the southern California coastline, high cash crops, and the cost of land and water and labor are such that it demands a certain kind of farming. Pastures and alfalfa and wheat and those kinds of crops simply would not survive in my area.

The avocado farmers, which we raise almost half of the Nation's avocados in my district, along with citrus and strawberries and a lot of other row-crop vegetables and so forth, high cash crops, are the kind of farming I have.

Well, gentleman farmers have come in and purchased land and put trees in, avocado trees in, over the last 5 years for tax incentives, almost entirely to shelter outside income, with no intent, really, of making farming their primary source of income or even looking at the viability of their crop as a production crop for revenue. It is simply a tax shelter. As a result, it has completely thrown the marketplace out of kilter in terms of production.

Dr. BENTLEY. I agree.

Mr. PACKARD. Now, after 4 years, those crops—it takes 5 years or 4 years for avocados to produce—and they are coming into production in great numbers, and it has completely thrown chaos into the avocado marketplace for the genuine small- and medium-sized avocado growers.

I don't know what can be done, but obviously, changing some of the tax incentives would probably change some of that chaos that takes place within the legitimate farming industry.

Dr. BENTLEY. That is right. Well, what it says, as we talk about an industrial policy or an agricultural policy, tax law turns it into policy. Well, there is a policy that you can produce and you don't have to worry about the market price quite as much as the person producing it. That gives a different kind of signal. If you had to look at the current market and project what the demand for avocados is going to be in 5 years, then that decision by a good operator, that would have an influence on the decision, whereas, with a tax incentive, you have a different set of factors coming into it, and it distorts the question.

I think it is a very important one, and that is why the whole business of looking at the tax structure gets to be very important.

Mr. PACKARD. It would appear to me that if a farmer is into farming primarily for tax incentives rather than for farming, then that would change or alter the farming industry significantly, and it may be that that will be an area we would want to look at as we get involved in that whole debate in the future as to what implications the tax mode would have on agriculture, and particularly on the small- and medium-sized farmers.

Dr. BENTLEY. Mr. Packard, I am tentative in answering of my own knowledge, but we have people in our universities that are working on this and are very much concerned about these questions, and if you would like to get into their research and more factual information based on studies, that would be more appropriate for people that are experts in the area, but I was speaking more from a personal feeling, which is fairly strong.

Mr. PACKARD. I sincerely appreciate your testimony and appreciate this hearing.

Thank you, Mr. Chairman.

Mr. VOLKMER. I have a few more questions.

Dr. Bentley, do you think it is possible that we could have extension in those areas where you have small- and medium-sized farms—and they are more prevalent in some areas of the country than in others—that we could have extension work as Dr. Kidd has testified that Florida A&M is doing to assist those specifically rather than just do it generically across the board for any and all?

Dr. BENTLEY. Yes. We have, in fact. Of course, Dr. Kidd's program is a part of our extension activity.

Mr. VOLKMER. Yes.

Dr. BENTLEY. We think of that as just as much a part of it as any other activity that we have.

Mr. VOLKMER. But I would like to ask you this.

Dr. BENTLEY. We do have some work in—

Mr. VOLKMER. Could I interrupt? I did not ask Dr. Kidd, and I should have. Was what they are doing a part of something that they formulated on the local, State—in other words, at the university level—or was it something that came from Washington, DC, down to them to do?

Dr. BENTLEY. Well, we like to think that our planning process does involve a grassroots involvement on that, and these came as recommendations, and as it worked out, the unique and important role for the 1890 institutions, and Tuskegee. Many of these institutions are dealing with a similar kind of program. This was part of an organized effort and a national planning—and this tends to be more regional than national—but we did give attention to this.

I think, in addition to the smaller farm, we have small farm program activities. Mr. Bud Kerr is leading up that effort. He is actually tied in—this is a linkage with the Agricultural Research Service and Extension. We think there are some places where there is a need for packaging information in a way that makes it more readily acceptable and easier to use by smaller farmers than large farmers in that sense, the same kind of information, but how you use it is different, the capital requirements, and we are doing that, and we have quite an extensive set of publications on that, and we would be glad to supply it if the committee would so desire.

Mr. VOLKMER. Do we have any specific research being done in the Agricultural Research Service or Cooperative Research Service geared just toward moderate-sized farms, medium-sized farms, whether in crop or livestock?

Dr. BENTLEY. Well, it is not specifically geared to the size of the farm but the nature of the problem as such that is more of a concern to the smaller farm. For example, I referred to forage production in the Northeast or in the dairy, some of the farms in the

upper Midwest area, including Missouri. The matter of forage production gets very important, and we are stressing that because there has been a tendency to drop away from research on forages as there was less importance for clovers and so forth in crop rotations when we began to replace crop rotations with the use of chemical inputs as fertilizer. There was a change, but we are trying to maintain work of that type.

We have research on small fruits—strawberries, blueberries, cranberries, et cetera—that tend to be grown by smaller farmers and coming up with new varieties. Almost all the States on the east coast and on the west coast as well, but certainly on the east coast and in the South, are doing research on various kinds of specialty crops that are uniquely fitted to small farms.

I guess that is why I feel the small farm will always have an important niche in this, because the richness and the diversity of the American diet is in part supplied, not wholly but in part supplied by small farmers that provide specialty crops.

One has to remember that you can go into a supermarket today—and I don't know if my numbers are absolutely correct, but they are relatively correct—that, 25 years ago or 30 years ago, from probably 30 to 50 items in your vegetable specialty area was about the average for a supermarket. At least this is the complaint of the supermarkets when you talk to them about costs.

They say today if you are going to be a good store, your number of items in this area approaches 150 to 200 different items, and I know from my own experience, shopping in the supermarkets here in Arlington, that you will find a great diversity of products that just amaze me. There are tropical type fruits and vegetables, and many of these are produced in the United States today, and that often comes from smaller farms.

Mr. VOLKMER. I assume, then, that you actually see no necessity for making any changes in USDA research direction as far as trying to gear research directly for moderate- or medium-sized farms.

Dr. BENTLEY. Well, I would hesitate to suggest we should have earmarking for certain size farms. What I think we need to do is to stress through our research and planning the need for giving attention to the whole diversity of farms, from small to large.

Then, of course, is the question of resources. Sometimes we cannot do everything that we think we should do or could do, and that makes a difference, particularly when we come to some of the areas where the generic research might fit adequately. We wouldn't then do a specialized type of research.

Mr. VOLKMER. But that is not necessarily the same as far as Extension, then, is concerned, though. Basically, couldn't Extension be utilized to some degree more directly toward the small- and medium-sized, as we heard from Dr. Kidd?

Dr. BENTLEY. Yes. As I see it, one of the things that needs to be done in that is to be able to try to tailor information so that it can be used the best by the consumer, the person, the target clientele.

If you are dealing with a very large farm organization that may have a research staff of their own, they don't really—they may need information to get it, but you don't have to package it very much because you've got another agronomist talking to an agrono-

mist, and it starts out, "Hey, Joe, I've got a new variety." "What kind is it?" And you give him a number and that is all you have to have because they both know about the information.

A smaller farming unit may need to have more of the traditional, conventional type of extension education that probably I knew about as a youngster, where you are going to have to talk about the farm management, what it means to organize your credit a little bit more, and what investment means. What does it really cost out here? You know, there are a lot of farmers, and the people that are in the farm management area in the extension will tell you that the pathetic thing about it is that you talk to a farmer that has quite a little land and property and feels he is doing quite well, but if you really analyze it, he is gradually eating up his net worth. The sad part of it is not only that it is occurring, but that the person themselves have not analyzed their affairs well enough to know that is what is happening.

We see this, I understand, in small stores. That is the problem. People are doing rather well, but you ask them, well, how's your inventory, how many pairs of shoes do you have compared to last year? Well, they say, we've got 25 percent less. Well, someplace they have used up the inventory without maintaining their net worth.

So I think farmers get into this, and this may sound pretty simple and pretty elementary, but I would think that we can help a great deal there; and if we could get the resources, I believe we could do a great deal in the small farm area if we could—well, all size farms. It isn't just small, but I mean in farms—

Mr. VOLKMER. But it is probably more needed on the small-sized because the large farms, most of them, are already doing it.

Dr. BENTLEY. But it is probably more needed, so it is a matter of need. It is a spectrum of needs. It isn't that one is so different from the other. It is just that certain people need more, and if it is public policy, we should do this, then we should have the resources. That is at least one approach that I think would be valid.

Mr. VOLKMER. You also touched on, and the OTA report looks at, another area that concerns me in the future as to what is going to occur.

Our land-grant colleges have been more or less in the forefront in doing a lot of the research in the past, basically funded through public funds, but now we are seeing more and more private companies coming in and working with those same basic researchers at those same schools, and then you get the question of the patent and the patent rights.

Does that disturb you to any extent?

Dr. BENTLEY. Well, I don't think it disturbs me from the standpoint of being totally afraid of it, but it does raise a question about it being important that we maintain our institutional mission and institutional status.

So the delineation of what the nature of this relationship is and the basis under which the work is to be done has to be worked more in detail and much more carefully than we probably had to do in the past.

I think that most universities I have talked to, and most university presidents and most research directors, deans of graduate

schools, are much concerned about this and are trying to be sure they have a working relationship that does allow for freedom of publication.

It is mostly a matter of getting out information, who publishes it, and that becomes—When I was in my last duties at the University of Illinois I spent a year negotiating over a very fine arrangement, and the question came down always to who is going to release the information, who is going to own the information, because it had to do with seed production, plant genetics. In Illinois there are a lot of small seed companies that are—it is one of the places where there are quite a few of them left, and they were deeply concerned about, is this arrangement going to tie up one of the best corn breeders in the United States or not, and we finally did work out and have some arrangements that I think were quite acceptable.

I use that as an illustration of the kinds of questions that come up. Yet we cannot, it seems to me, in terms of national competitive position, we cannot shy away from trying to work things out, and that is why our interactions lead into some good discussions with the Department of Commerce, Dr. Bruce Merrifield.

We met repeatedly to talk about this matter of how do we encourage the joint effort between the private and the public sector but at the same time protect the traditional values and so forth, and it is not easy, but I think we can find ways to do it.

Mr. VOLKMER. Well, I am just concerned, not to the point that I am concerned about the efforts of the private enterprise, whether it is a chemical company or seed company or anybody else, coming in and funding those land-grant universities. What concerns me is that the ability, the information being made public and also the utilization of whatever technology is developed, being able to utilize instead of just going to maybe one sector, and that company or somebody being the sole profiteer from it. That is what concerns me to some extent.

Dr. BENTLEY. Well, I share that concern. On the other hand, we have had at some of our major laboratories in agriculture, but it is probably even more of a concern in energy laboratories, where you have technology that is there and has potential for benefiting society and consumers but is not being developed because there is not an adequate way for the private entrepreneur to get a right to licensing in it to warrant putting an investment, because it is frequently 10 to 1.

In some of these limited partnerships in biotechnology, as an example, if it costs \$1 million to do the research, there should be \$9 million there for development, because the development is a costly process. Scaling up from a test tube to a big vat for fermentation may not look like much from the outside, but going from the test tube to that larger production with all of the quality controls, meeting the needs for registration, et cetera, does require money, and we must find a way to solve that.

Mr. VOLKMER. I would like to yield to the gentleman from California.

Mr. PACKARD. Mr. Chairman, I cannot resist, before we let the representative from the Department of Agriculture go, without asking a question that may be a little unrelated to our hearing today, but I take every opportunity to ask the question.

In my district, we raise, again, about 40 percent of the Nation's winter tomato crop, shipping tomatoes. They are banned from using certain chemicals and pesticides and fertilizers.

Across the border, not more than 40 miles away in Mexico, they are raising tomatoes in greater and greater numbers in direct competition to our growers, and they use those same chemicals and pesticides, and then we accept them and bring them into our country and compete right in my own neighborhood with the—and that is not only tomatoes. That is true with my cut flowers, and it is true with other commodities that are in direct competition.

Our farmers complain that they can compete if they have the same rules. It is inconceivable that we would permit a crop of tomatoes to come into this country having used the chemicals and fertilizers that we will not permit to be used, and then we consume those same products. How do you answer that? How can that be?

Dr. BENTLEY. Well, I could use a disclaimer saying that that is not a direct responsibility of the Department of Agriculture, but that does not answer the question.

The question that you have is absolutely right, though. I think that as we have done with meat inspection and so forth, we are trying to say there should be the same standards throughout another country, and the same quality control.

I don't know the specific details, but that is still a question. The EPA has a lot of rules, and I agree with the risk management and risk assessment, and we should do this. But the matter of consistency almost goes back to the question you raised earlier on tax. It is a matter of consistency, how do we do these.

I think we are going to have to take a very careful look at that. I cannot personally see how we can justify that.

Mr. PACKARD. Thank you.

Mr. VOLKMER. Thank you very much, Dr. Bentley. I appreciate your being here and your testimony today.

This subcommittee will take a closer look at the future of specific areas and technologies for agriculture. On April 16 and 17 we are going to focus on biotechnology for agriculture. Thank you very much.

Dr. BENTLEY. Thank you.

Mr. VOLKMER. This will conclude the hearing today.

Dr. Bentley, for the record, I would like to know, did you wish to have these publications included in the record? If you do, we can have it done.

Dr. BENTLEY. Well, I think the comment we made was that we would like to have these two included in the record, and we would leave it up to the committee if you would like to include this one in the record. This is a regular publication, but it contains a lot of information on new developments in agriculture research, and it has just come out. I would leave it that way, because this has to do with planning.

Mr. VOLKMER. For the record, we would like to have the publications, "Extension 1984-1987" and "Regaining Farm Profitability in America" as part of the record following Dr. Bentley's statement.

Dr. Kidd, since we are still on the record, can I ask you a quick question which I forgot? Even though we have concluded, we have not concluded. [Laughter.]

I forgot something. The program that you have on the small farms at Florida A&M, was that developed basically locally, or where did you get the ideas for those programs?

Dr. KIDD. Those came from some of the people who actually worked there at the university. It is a local development to do it that way, to integrate the efforts of extension and research and instructional personnel and bring them to bear on our experimental farm.

Each segment, research and extension, being a part of an overall program sponsored by USDA, had to be described, so we described them separately, so to speak and they fit the overall pattern for the State and for the Federal effort, but at the same time, they come together as far as A&M is concerned to focus on the problems of small farmers.

Mr. VOLKMER. But you basically developed them right there at the university?

Dr. KIDD. We developed them right at the university.

Mr. VOLKMER. Thank you very much.

This concludes the hearing. The subcommittee stands in recess. [Whereupon, at 11:39 a.m., the subcommittee recessed, to reconvene at the call of the Chair.]

APPENDIX

ADDITIONAL STATEMENT FOR THE RECORD



UNIVERSITY OF MISSOURI-COLUMBIA

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April 8, 1985

The Honorable Harold Volkmer
2485 Rayburn House Office Building
Washington, D. C. 20515

Dear Congressman Volkmer:

Thank you for providing me with an opportunity to comment on the OTA report "Public Policy and the Changing Structure of American Agriculture: A Special Report for the 1985 Farm Bill." My comments are enclosed.

I will be glad to discuss my comments, if you have questions.

Sincerely,

J. Bruce Bullock
Chairman

JB8/jb

Enclosure

COMMENTS ON THE OTA STUDY "TECHNOLOGY, PUBLIC POLICY, AND THE CHANGING
STRUCTURE OF AMERICAN AGRICULTURE:
A SPECIAL REPORT ON THE 1985 FARM BILL

by

J. Bruce Bullock, Professor and Chairman
Department of Agricultural Economics
University of Missouri, Columbia

The report does an excellent job of identifying the role of technology in stimulating and facilitating change in the agricultural sector. The report contains a large amount of information that policy makers will find useful as they address policy issues related to the development and implementation of new technology.

The only comments I have relate to the report's discussion of the effect of agricultural research and extension on the structure of agriculture. As the OTA report correctly points out, the technology adoption process will cause structural change even if the technology and the information delivery systems are structurally neutral. This implies that the research and extension systems would have to be biased in favor of moderate size farms to overcome this situation. However, this is an impossible task and should not be attempted.

There are some technologies that can be used effectively only in large scale operations. However, there is no cost reducing technology for moderate size operations that cannot also be used in large scale operations. Even if the technology provides no special advantage to large scale vs. moderate scale operations, the large scale operations can use the new technology in multiples of the operation adopted by the moderate size firms. Thus, even if moderate size farms adopt the technology earlier than their larger counterparts, the advantage is short lived.

Managerial skills are an important determinant of economies of scale and firm size that is not fully understood. Since the business management skills of farmers are not identical, efforts to skew the agricultural research and extension programs in favor of a specific size farm will not be successful. Moreover, even if it were possible, it would not be in the best interest of society.

Society's best interest is served by pushing the frontiers of technology (and adoption of that technology) forward as rapidly as possible given the amount of resources allocated to research and extension. If policy makers decide for some reason that the adoption of that technology is resulting in an "undesirable" structure of the farming sector, then policies should be implemented that deal directly with the structure issue and cause the desired structure to evolve. For example, impose differential taxes on the large size and moderate size operations that remove the profit incentive to expand beyond moderate size. This approach is preferable to biasing the research and extension program in favor of moderate size firms for at least two reasons.

First, the taxation approach does not interfere with the efficiency of the technology development process. It does perhaps interfere with the adoption process. However, if at a later date adoption of the new technology is desired, changes in the tax laws could stimulate rapid adoption of the technology. The new technology might not exist if the technology development process is slowed down.

Second, a tax policy to alter structural change will make it possible to identify the costs and income transfers associated with altering the agricultural structure relative to the structure that would evolve

in the absence of the barriers to structural change imposed by the government program. There are indeed certain aspects of unrestricted structural change generated by introduction of cost reducing technology that may be viewed as undesirable by policy makers. However, the costs and benefits of modifying the nature and/or rate of structural change in agriculture should be clearly identified. Attempts to alter structural change by altering research and extension programs will (a) be less effective (than more direct policies) in altering structural change, and (b) run the risk of restricting the rate and/or altering the nature of technological development. This policy approach increases the risk that technology could become a constraint on expanding food supplies and that U.S. agriculture could lose its technological edge in producing products for international trade.

There is legitimate public concern about the changing structure of U.S. agriculture. Unfortunately, this concern may have been 30 years too late in coming. Structural change is a slow process. The current structure of agriculture is the result of economic forces that have evolved over the past 30 years. Moreover, the structure of agriculture in 1995 is to a large extent already determined by the developments of the past 10-15 years. Altering the trends in the structure will require substantial and well targeted efforts to overcome the powerful economic forces that are already in motion.

Over the past 30 years farming in the United States has evolved from being a way of life to a high technology - highly capital intensive business. The introduction of new technology has enabled the U.S. to have unparalleled increases in agricultural productivity. Moreover, new

technology has removed the drudgery from a large part of the agricultural production process. Technological developments are, to a large extent, responsible for the low proportion of income that the American Consumer spends for food.

New technology has also drastically changed the level of business management skills required to operate a successful farm business. Moreover, these new technologies have increased the minimum size of an economically viable farm business. Economies of scale provide information about the relative production costs for alternative size firms. However, it tells us nothing about the minimum size firm required for economic viability. Production costs as a percent of gross sales have increased from 67 percent in the 1960s to 80 percent today. Consequently, the minimal size, economically viable firm increased at least 65 percent over this period. The economic realities of 1985 are that the minimum size of a farm business is larger than what the OTA report defines as a moderate size farm. Annual gross sales of at least \$200,000 are required to generate a \$20,000 management income to the farm operator. There may be good reasons for public policies to maintain farms of smaller size. However, policy makers should recognize that farms of smaller size are not economically viable businesses. Moreover, the most efficient method of maintaining the existence of these less than economically viable size farms is to target direct income payments to the group to be sheltered from today's economic realities.

Advances in agricultural production technology have freed the economically developed portions of the world from the constraints of inadequate food supplies. The world's finite natural resource base and growing human population suggest that it would be unwise to restrict the rate of new technology development in order to alter the nature and/or rate of structural change in U.S. agriculture. If observed structural changes are judged to be socially undesirable, then policies other than altering the development of new technology should be considered.